UNIVERSAL MODEL AIRPLANE NEWS

FEBRUARY

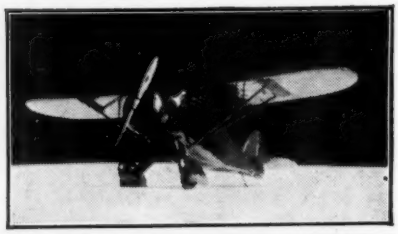
20¢ Canada 25c

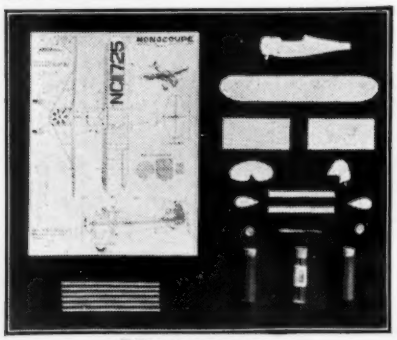
FEATURING NATIONAL AERONAUTIC ASSOCIATION JUNIOR MEMBERSHIP NEWS

THE DE HAVILLAND COMET

Read About These Dandy Solid Wood Kits

100,000 Purchasers Can't Be Wrong!!



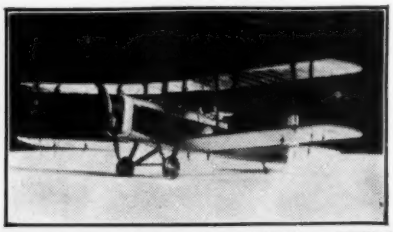


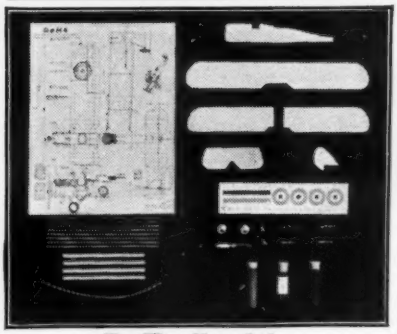
Monocoupe

You can not go wrong with

HAWK'S KITS

All with
1935 Improvements





De Haviland 4

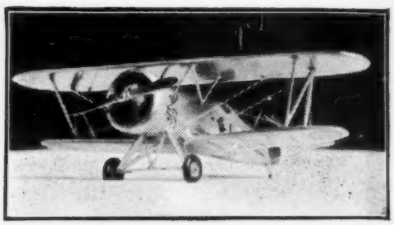
4 for $1.50 plus 10% for postage

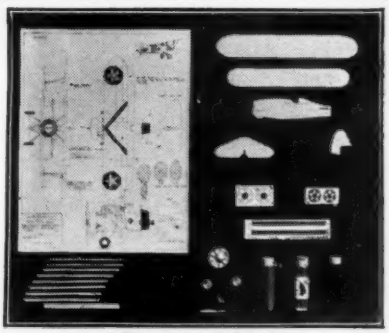
Exact ¼-inch Scale Models—Solid Wood

You will like these kits. Try them. You will want more. Be the first in your neighborhood to have them.

Here is what you get

Each Hawk Kit contains all wood parts, as fuselage, wings, stabilizer, and rudder, CUT TO OUTLINE SHAPE. Die cast machine guns were required, die cast propellers and wheels are furnished in each kit. Kits requiring radial motors have die cast motors included. All sets have formed metal seats, good paint, glue, insignia and real scale plans. PROOF of this can be seen in these pictures.





Boeing F4B-3

We Offer You the Following Kits

Any 4 for $1.50 plus 10% for postage

Exact ¼-inch Scale Models—Solid Wood

Pick them out now—immediate delivery guaranteed. Send Now.

Ansaldo S.V.A.
Westland Wagtail
Fokker Triplane
Boeing P26
Boeing F4B-3
Bristol Fighter
B/J Seaplane
Curtiss Racer
Nieuport 17
Hawker Fury
Sopwith Pup
Curtiss Swift
Nieuport 28
Supermarine
Halberstadt

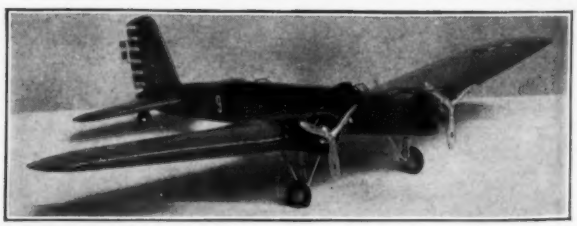
Hawk P-6-E
Navy Racer
S.E.5A
Fokker D7
Fokker D8
Pfalz D12
Hawk P-5
Albatross
Pfalz D3
Autogiro

Spad 13
B/J 16 Camel
DeHaviland 4
DeHaviland 5
Monocoupe
Vought V65

SINGLE KIT
50c
plus 10% for postage

BOEING TRANSPORT

BOEING BOMBER Y1B-9A



Now you can build the Boeing Transport or the Boeing Bomber pictured here and have an exact ¼ inch scale replica model for $1.65

The kit sets contain all the wood parts cut to outline shape, two scale die cast Wasp Motors, two scale die cast three bladed propellers, all ready to mount, and cast wheels. These castings are made of Brittania metal and do not have to be hand finished. A full size 18½ inch wing span plan, glue, paint, etc., comprise the kits. When you consider that the fuselage, wings, rudder, and elevator are cut to shape and NOT blocks of wood, motors and propellers are ready to mount, and the size of the plane, 18½ inch wing span, you will realize we have produced a construction set that is in a class by itself. We guarantee these kits to be as stated, and know you will be satisfied.

BOEING TRANSPORT KIT, wingspan 18½ inches, in Pine or Balsa $1.65 plus 10% for postage

HANDLEY-PAGE KIT, wingspan 25 inches, in Pine or Balsa $3.00 plus 10% for postage

BOEING BOMBER KIT, wingspan 18½ inches, in Pine or Balsa $1.65 plus 10% for postage

GOTHA BOMBER KIT, wingspan 19¼ inches, in Pine or Balsa $1.65 plus 10% for postage

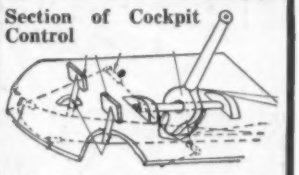
HAWK MODEL AEROPLANES, 4946 Irving Park Boulevard *Dept. W8* CHICAGO, ILL.

New Movable Cock-Pit Control Amazes Model Airmen!

A Gold Seal Achievement In 24 Inch Flying Models

Here's a real treat for model airmen! Think of it. These Gold Seal 24" flying models have cockpit control . . . a well known ace said, "This is nearest to the real thing he ever saw" . . . read our other startling offers and note the exceptional values for this high quality line.

Section of Cockpit Control

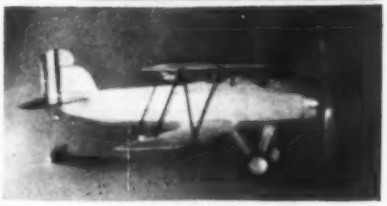


It's Movable!

This sectional cut shows you how Gold Seal cockpit movable control operates. Precision made by expert airplane engineers . . . easy to install with the Gold Seal simplified ABC plans . . . you'll get the kick of real flying with this new feature.

ALBATROSS D5A

DOUGLASS 038



HELL DIVER

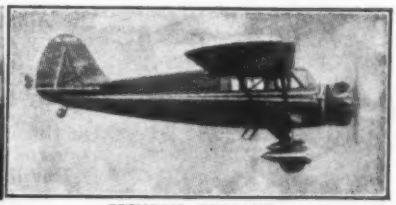
All Record Breaking 24" Flyers . . Take Your Pick → $1.00

Postage 15c Extra

Here they are boys . . . take your pick . . . aren't they beauties? They are the newest Gold Seal fleet of 24" flying models with the new movable cockpit control. Control Wires are so designed that they will not interfere with your rubber motor. Kit contains all horns, pulleys, and hinges ready made, ¾ finished wheel pants, two colors tissue, all parts printed on Balsa, aluminum spun cowl, finished propeller. Fully detailed plan and complete instructions, cement, dope, etc. Without doubt, the most elaborate Kits ever offered to the model builder. There are six models to choose from: **Curtis Swift, Spad, Douglass 038, Albatross D 5A, Hell Diver, Stinson Reliant.**

CURTISS SWIFT

SPAD



STINSON RELIANT

Outstanding Value In 20" Flyers

Here are four 20" flyers . . . all boasting of record holding flights. These Gold Seal kits are the talk of the model aviation world.

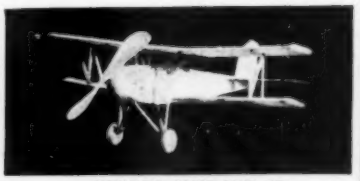
20" COMMANDER

VERVILLE AIR COACH

What a surprise you have in store! You will be amazed when you receive one of these 20" flying kits . . . a value that defies competition. Kit contains full size plans and instructions, all printed parts, cement, colored tissue, wire, rubber, wheels, strips, etc. Four models to choose from at 50c price: **Heath Parasol, Verville Air Coach, Commander, Curtiss Wright Coupe.** Price of **Drigg's Skylark 75c** plus 15c postage.

50c Each Postage 10c Extra

HEATH PARASOL



DRIGG'S SKYLARK 75c

16" Flyers

FAIRCHILD 22

Contains printed balsa parts, 2 colors tissue, wheels, wire, rubber, wood veneer, full size plan, dope, cement, etc. 8 models to choose from:

Fokker D 1, Goshawk, Howard Ike, Fairchild, Waco, Nieuport, Fokker Triplane, Curtiss Falcon

30c Ea Postpaid

12" Solid Replica Models

With die-cast propeller, 2 bottles color, cement, printed balsa parts, etc. 10 models to choose from: **Douglass, Gee Bee, Fairchild 24, Bristol Fighter, Monocoupe, Spad, Aeronca, Boeing X P 936, Stinson, Flamingo.**

30c Ea Postpaid

GEE BEE

12" Flying Scale Models

Contains printed parts, wheels, cement, rubber, prop block, tissue, etc. 8 models to choose from: **P. T. Army Trainer, De Havilland, Hell Diver, Monocoupe, Boeing Bomber, Arrow Sportster, Spad, Gee Bee D.**

15c Ea. Postpaid

How To Order

Send name and address. Mention planes wanted. Enclose amount and postage.

DEALERS—Send for pricelist of the most complete model airplane line in the world. 75 different models from 10c to $1.00.

CONSTRUCT-A-PLANE CO., Inc.

158 Graham Ave., Dept. 202, Brooklyn, N. Y.

VOL. XII *NO. 1*

Edited by Charles Hampson Grant

CONTENTS

FEBRUARY, 1935

Acrobats of the Sky
By Lieut. H. B. Miller 4

Build This World Record Glider
By Robert File 6

The Le Pere Fighter (3 View)
By Willis L. Nye 8

The Albatros Fighters on Parade
By Joseph Nieto 9

Fundamentals of Model Airplane Building
By Edwin T. Hamilton 10

On the Frontiers of Aviation—*Including*
How to Build Solid Scale Models of the
DeHavilland Comet and the Bellanca Racer
By Robert C. Morrison 13

More About Microfilm
By Herbert Greenberg 15

Air Ways—Here and There 16

Building the Dewoitine D-33
By Stephen Faynor 19

The Aerodynamic Design of the Model Plane
By Charles Hampson Grant 22

Slipstreams 24

Illustrated Aviation Dictionary
By Edwin T. Hamilton 26

The Midget Indoor Tractor
By Frank Helm 27

N.A.A. Junior Membership News 28

Aviation Advisory Board 32

NRA MEMBER U.S. WE DO OUR PART

In Our Next Issue

Lieut. H. Latane Lewis II tells you how the dangers of flying in fog are being eliminated in his interesting article, **New Developments in Blind Flying.**

Building the Famous Udet Flamingo, by William Winter, tells you how to build a flying scale model of a popular German sport and stunt plane used by the famous War Ace, Udet, at the National Air Races.

Marshall Mulvany provides an unusual feature for you in **How to Build a Smoke Screen Model.**

Robert C. Hare gives you interesting data on the famous German war plane, the Fokker D-VII, in **The Development of the Fokker Fighters, Part No. 13.** John E. Roe gives you a super-detail drawing of this remarkable plane.

News of the latest developments in Aviation are given to you in **On The Frontiers of Aviation** by your old friend, Robert C. Morrison, as well as two drawings of the very latest planes from which you can build solid scale models.

There are many pleasant surprises and useful information in our other regular articles, such as **Slipstreams, Air Ways, Fundamentals of Model Airplane Building, The Aerodynamic Design of the Model Plane, Illustrated Aviation Dictionary, Aviation Advisory Board,** and **N.A.A. Junior Membership News.**

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Yes Sir! *C-D's represent more for your money than any other Kit, regardless of price...*

Why just look what you get in this 3/4" C-D Great Lakes Sp. Trainer

NAVY CURTISS F11C-2 FIGHTER

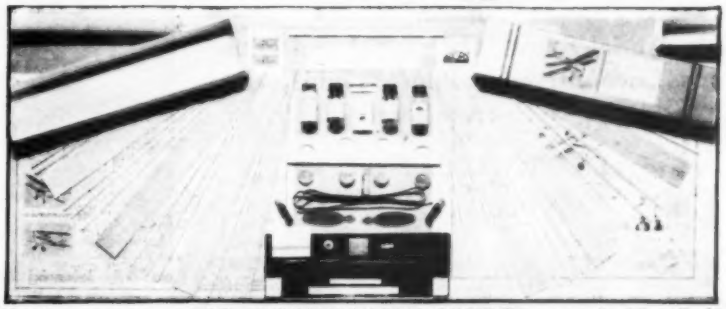
The ship which needs no introduction as it has already made an excellent name for itself in Navy work. This flying model is very beautifully colored the characteristic silver with gray fuselage, green tail surfaces, cowl and other colorful trimmings, ("Felix the Cat" insignia supplied, etc.) and yellow upper wing. Span 23⅝", length 16¾". Complete Kit SF-49..... **$3.75**

"SPEED" HOLMAN'S '30 LAIRD SOLUTION

It was piloted to victory by the late "Speed" Holman in the Thompson Trophy Classic. Model flies like the Super-Solution—at a fast clip. Authentically colored with special gold wings and tail surfaces, balance black. Span 15¾", length 13⅝". Order complete kit SF-40..... **$2.50**

COL. ROSCOE TURNER'S '34 WEDELL-WILLIAMS

Another ship needing no introduction since our beloved Col. Roscoe controls it wherever it is flown. It's the '34 Thompson Trophy winner. This fast flying model authentically colored—the special Wedell-Williams Gold, has a span of 19½", length 16¾", and weighs 2.9 oz. Complete Kit SF-48, postfree..... **$2.95**



THE COMPLETED MODEL

YES, it's just what you receive when you purchase a "Trainer" kit. Absolutely everything you need. The parts shown, too long a list to enumerate here, but as you can easily see, containing all necessary tissue, wire, liquids, 2 instrument panels, rubber, propeller material, balsa strips and absolutely every curved part necessary printed out on the balsa wood; last, but most important, the authentic never-to-be-duplicated C-D "Trainer" drawing which makes it possible for you to build realistic C-D models. The picture here shows the standard model, but wheel and routed-out wheel shoe blocks are supplied for the speedster model also, as described in the drawing. The model, colored cream and orange, has a span of 20", length 15¼" and may be had by ordering Kit SF-1G, postfree, **$2.65**

Remember! All 3/4" (SF) C-D Kits Are Just as Complete as One Shown Above

1G:	G.L.S. Trainer	$2.65	14B:	Fokker Tripe	$2.50	27:	Doolittles G.B.	$2.50	40:	Aeronca C-3	$2.65
2D:	T.A. Mys. Ship	2.95	15B:	Fokker D-7	2.95	28:	Monocoupe	2.50	41:	Vought Corsair	3.75
3B:	De Haviland 4	3.50	16B:	Albatross D-5	2.50	29:	Boeing F4B-3	2.85	42:	Howard "Ike"	.98
4:	Curtiss JN4D	3.25	17B:	Bayle's G.-B.	1.95	30:	Nieuport 28	2.50	43:	Douglas O-38	3.75
5B:	Laird Super Sol.	2.50	18B:	Howard "Pete"	1.35	31:	Hall Racer	2.75	44:	Page's Racer	2.65
6:	Polish Fighter	2.95	19:	Supermarine S.6B	2.50	32:	Boeing 95 Mail	2.50	45:	Martin Bomber	8.50
7B:	C. Hellidite	3.50	20B:	Hawker H.S. Fury	2.65	33B:	Comper Swift	1.25	46:	Laird Solution	2.50
8C:	Boeing P12-E	2.65	21B:	Hawk	3.25	34:	Fokker D-8	2.50	47:	Wedell, W-Wms.	2.95
9:	Sopwith SE-5	1.25	22B:	C. F9C-2	2.50	35B:	Boeing 247	8.50	48:	Turners W.-Wms.	2.95
10B:	Sopwith Camel	2.50	23:	Boeing P-26	2.50	36:	Lincoln Sport	.98	49:	Curtiss F11C-2	3.75
11B:	A-W Quad	2.50	24:	Lockheed Vega	3.25	37:	Waco C-3	3.25	50:	C. Turkey Hawk	3.75
12B:	Nieuport Scout	2.50	25:	Cur. A-8 Attack	3.25	38:	Buhl Bull-Pup	1.75			
13B:	Spad XIII	2.65	26B:	Heath Parasol	.98	39:	B. J. P-16	3.50			

C-D "DWARFS" the SENSATIONS Among Low Priced Kits

D-42 Howard "Ike"....25c

D-19 Supermar. S.6B..65c

D-37 Waco C-3.....75c

D-24 Lockheed Vega.....85c

All Authentic ½" Scale. Other "Dwarfs" now ready are **D-1G** Great Lakes Sport Trainer 65c, **D-8C** Boeing P12-E 65c, **D-20B** Hawker Fury 45c, **D-23** Boeing P-26 65c, **D-26** Heath Parasol 35c, **D-27** Doolittle's Gee-Bee 50c, **D-29** Boeing F4B-3 85c, **D-33** Comper Swift 50c, **D-40** Aeronca 60c, **D-41** Vought Corsair 85c, **D-43** Douglas O-38 85c. Complete set postfree (15 Nos.) $10.00. Kits complete, except for liquids. If ordering by mail, add 10c per kit for handling and packing charge. Don't delay building these. Now you may buy several at once—the low price permits it.

There is not another line of small kits available to compare with the "Dwarfs" in any way.

"Jimmie" Wedell's '33 Wedell-Williams

Yes, this is the '33 Cup Winner which Jimmy Wedell himself flew to victory. It was also flown by the late "Doug" Davis in the '34 Thompson Race after winning the Bendix Prize. This model is a VERY beautiful version of this design with its numerous fuselage stringers authentically duplicated, authentic rib spacing just as on the new Hawk, and practically all the new C-D designs, it employs a "full" motor and an actual N.A.C.A. cowl (easily made) enabling you to see the opening behind the motor. Colored red with its characteristic black scalloping and bronze motor crankcase and color separations. The model weighs 2.9 oz. and has a span of 19½" and a length of 16¾". It is capable of excellent speed flights. Entirely complete with all printed wood—just hundreds of parts included. Send for complete Kit SF-47..... **$2.95**

HAWK P6-E

We claim for this model the distinction of being the finest and most complete authentic flying model on the market today. Even exhibition models could not outclass this new beauty for external appearance—and she flies very well, too! Colored the usual yellow and olive-drab of the Army with the beautiful color marking of the Selfridge Field Squadron with its characteristic black and white; with black lettering and red striped top wing, along with the red, white and blue insignias, and the "super" authenticity, this model is taken out of the model-building class of hobby work into one of almost scientific precision duplicating. The model should make a 100% wind tunnel model. Every possible detail, wing ribs, stringers, etc., reproduced. Span 23⅝", length 16¾", weight 4.9 oz. Just order the C-D. Complete Kit SF-21B, post free..... **$3.25**

DEALERS!

And Clubs too—Send for discount sheet at once on these sensational year 'round sellers. 1935 is going to be a real year for dealers featuring the increasingly popular C-D models. Liberal discounts.

Read Before Ordering We have absolutely no connection with any other manufacturers so if your dealer can't supply you, send all orders to the address below. We pay postage on all kits in U.S.; if you live in Canada, Mexico or British Isles, remit 10% extra; elsewhere, 20%. Special Delivery service 20c extra per kit. C.O.D.'s 25c each order, additional, accepted only when a dollar is remitted to assure acceptance.

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MODEL & SUPPLY COMPANY INC.

1866NB West 57th St., Cleveland, Ohio, U.S.A.

2 FULL SIZE Model Pictures

2 Full-Size Model Pictures contained in newest C-D No. 16 catalog. Also describes all C-D ¾" and ½" authentic scale models, and complete line of quality parts and supplies. Send 5c at once for your copy.

Acrobats of the Sky

How Aerial Stunts Originated and Difficulties Encountered by Pilots While Learning to Execute Them

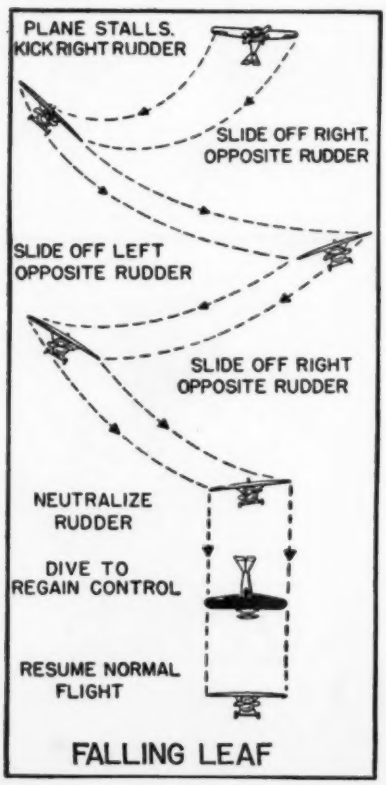
By LIEUT. H. B. MILLER

Part No. 2

Lieut. M. B. Gardener in inverted flight over Washington, D. C. (Official photo, U. S. Navy)

THE first maneuver ever done in a flying machine was the tail spin, although it was many years before men knew exactly why their machines fell under certain conditions. Soaring aloft in gliders, they would suddenly find themselves whirling madly about and in very short order they would come into violent contact with the hard earth. If they escaped death, they were frequently disabled for long periods of time and often this removed their enthusiasm for aeronautical adventures.

It was some time before scientific experiments proved conclusively that the crashes resulted from loss of flying speed, and even though this fact was discovered, it did not eliminate the problem. The difficulty of controlling the gliders which made their appearance in the nineteenth century, was at the root of the trouble. Practically all of these machines were controlled by the operator shifting his weight.



Obviously, when a sudden upward current cocked the glider from its normal gliding position, it required quick action by the operator to compensate for this new condition. It is not surprising that many of these courageous men eventually encountered conditions which they could not overcome. Even the great Lilienthal with the experience of hundreds of flights, succumbed when his glider was thrown out of control by a gust of wind.

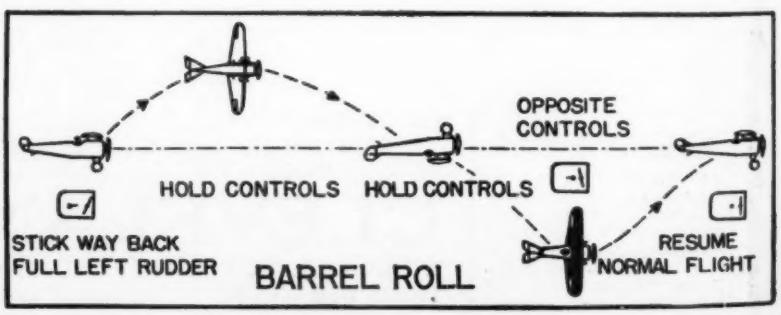
Long before the Wright Brothers flew their fragile craft at Kitty Hawk, it was apparent to men with keen scientific perception that human flight was a certainty, providing three problems could be overcome. It was necessary to provide sustenation or lift; a power plant which was able to pull the machine through the air sufficiently fast to provide a flow of air over the surfaces; and thirdly, proper control must be provided for the craft.

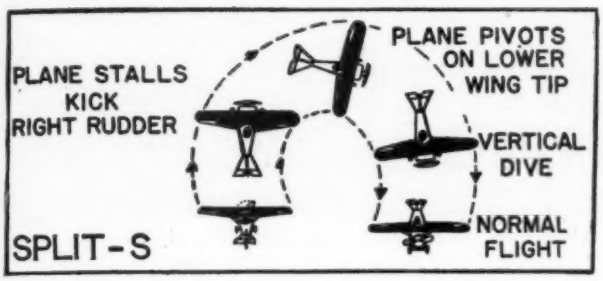
Fortunately, today all three of these requirements have been efficiently met, but still the spin remains the cause of a majority of aviation accidents. This in spite of the thorough knowledge that experienced pilots possess of this maneuver. It is apparent that carelessness and over-confidence become most important factors in the spin. At other times, an inexperienced pilot will get into similar trouble merely because he fails to recognize the symptoms of impending loss of control and accordingly fails to take appropriate action.

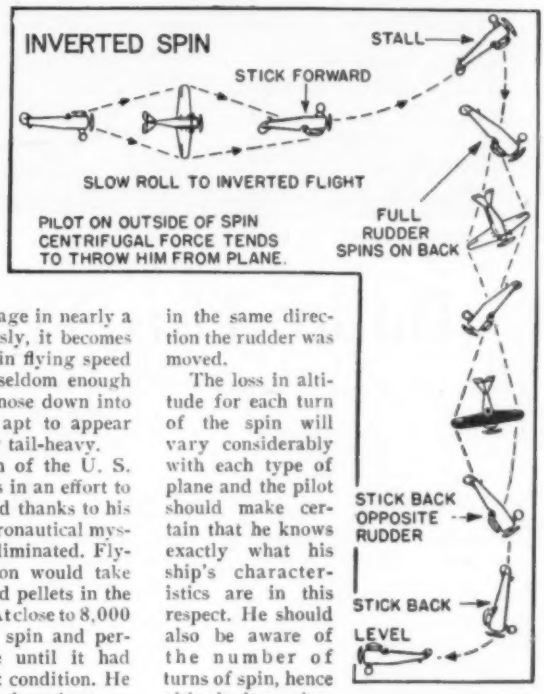
It is because of the dangerous possibilities which are inherent to the spin that the observer on the ground thrills when he witnesses a plane spinning madly downward towards earth under the guidance of an expert pilot. Although a dangerous maneuver, the onlooker knows that at the correct instant the trained hand of the aviator will manipulate the controls in the proper manner, bringing the plane out of its dizzy whirl. Thus it happens that the most dangerous of all acrobatic stunts becomes the most intriguing to those observing an airshow.

Just who was the first airman to recover control of his craft after he once entered the heretofore fatal tailspin, will probably never be known. There are many versions of this important event, each of which is warmly sponsored by its adherents. One story records that a French pilot suddenly lost control of his craft which at once entered into the dizzy spin which always resulted in a bad and possibly a fatal crash. In despair the pilot threw up his hands and the inherently stable plane stopped spinning and entered a moderate glide. His account of this remarkable performance was scarcely believed by his fellows on the ground, but the grateful aviator repeated the maneuver with the same successful results.

Although the above version makes an enjoyable anecdote, it is more probable that some of the pilots of the 1913-14 era finally decided that some method must be devised for giving flying speed to a plane which had gone into the dreaded spin. It was deduced that the craft must be placed into a dive and at the same time the rotating motion must be stopped by applying opposite rudder. A brave pilot it was who went aloft to demonstrate in practice what had been arrived at in theory. This discovery was found feasible and it was no time until the good word had been passed







around amongst aviators, of every nation.

The expression "tail-spin" was applied to this evolution because of the appearance of the tail whirling about the nose of a plane. This is not the best name for the maneuver and it has led some people into thinking the plane falls tail first when in a spin. A much more accurate name would be "spinning nose-dive." As a matter of fact, the expression has been reduced to the word "spin" and this is sufficient for all purposes of description.

A plane spins because it is stalled; that is, its angle of attack becomes so great that the burble point is exceeded. The point of maximum lift is passed over and the wing foil's lift drops to a point less than that necessary to sustain the weight of the plane in the air. A yawing force will generally be set up which will start the plane whirling in one direction or the other. However, a skilled pilot if he desires, can by a judicious use of his rudder, keep a plane in a stalled position while at the same time preventing it from whirling.

The center of rotation of the spin is not necessarily within the fuselage of the airplane. As a matter of fact, it is frequently at a point well forward on an extension of the plane's fore and aft axis. In this case, the whirling plane will cover a considerable area in its sweep and generally will spin at a slower rate of speed because of the resistance offered to rotation by the fuselage.

Because of the heavy engine forward, most airplanes will spin with their nose well down but the flat spin has made itself known during the past few years. Here the nose of the craft works up after a few turns of the spin and in extreme cases the plane rotates with the fuselage in nearly a horizontal position. Obviously, it becomes much more difficult to regain flying speed in this event for there is seldom enough elevator control to get the nose down into a dive. This condition is apt to appear when a plane is exceedingly tail-heavy.

Lieutenant Harry Sutton of the U. S. Army carried on many tests in an effort to analyze this type of spin and thanks to his dangerous work, another aeronautical mystery has very nearly been eliminated. Flying a fighting plane, Sutton would take off with a heavy load of lead pellets in the after-part of the fuselage. At close to 8,000 feet, he put his craft in a spin and permitted it to remain there until it had worked into a definitely flat condition. He then worked his controls and made every endeavor to get out of the spin. Sometimes after many turns his plane would respond to the controls, but at other times none of his desperate efforts were of any avail. In the latter case he would trip a valve which would permit the lead shots to fall from the plane, thus correcting the condition of tail-heaviness. With the weight thus removed, he was enabled to coax his plane into a dive and hence effect a recovery from the spin.

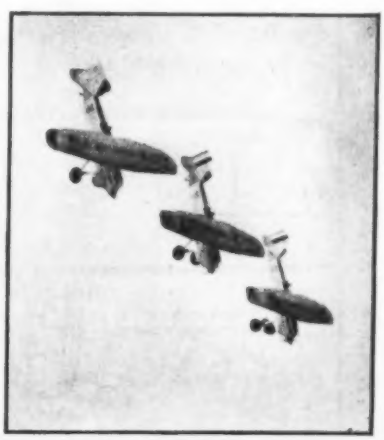
The normal method of entering a spin is to pull the plane slowly upward until the wings will no longer carry the weight of the craft. Then, with the control stick all the way back, kick full rudder in the direction it is desired to spin or whirl. The nose of the craft will fall sharply downward until the vertical velocity gives enough slipstream to act on the rudder. Obviously, the tail of the plane will be pushed away from the rudder, and consequently, the nose of the ship will move in the same direction the rudder was moved.

The loss in altitude for each turn of the spin will vary considerably with each type of plane and the pilot should make certain that he knows exactly what his ship's characteristics are in this respect. He should also be aware of the number of turns of spin, hence altitude, it requires for his craft to come under control from the time the controls are first applied for recovery. The normal pursuit plane will respond almost instantly to the controls, although even they may require a turn or more for recovery if they have been in several complete turns of the spin. A good thumb rule to follow is that if a plane is hard to place in a spin, it will recover only with difficulty.

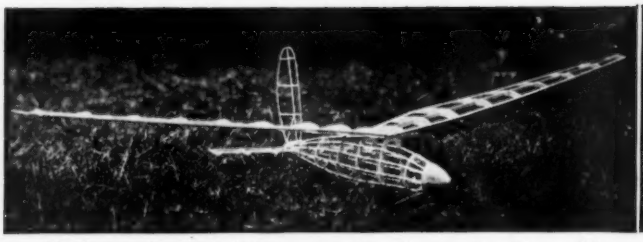
Recovery from a normal spin is a simple matter providing a pilot has sufficient altitude available and he keeps his wits about him. He must remember that his ship lacks flying speed. Therefore, he must nose it down until he gains this air speed. Further, he must stop the rapid rotation by kicking hard on the rudder bar in a direction opposite to rotation. Ailerons offer no assistance in recovering from a spin. Instead, they may very well resist recovery in that they offer a certain, though small,

(Continued on page 34)

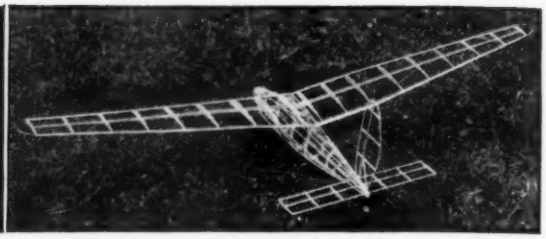
F6C-4 Hawks stunting. The leader is in inverted flight



F6C-3 fighters in a dive



Efficient design and light construction characterize this model



The completed framework ready to cover

Build This World Record Glider

How This Glider Set a World's Record, and Complete Instructions That Will Enable You to Build It

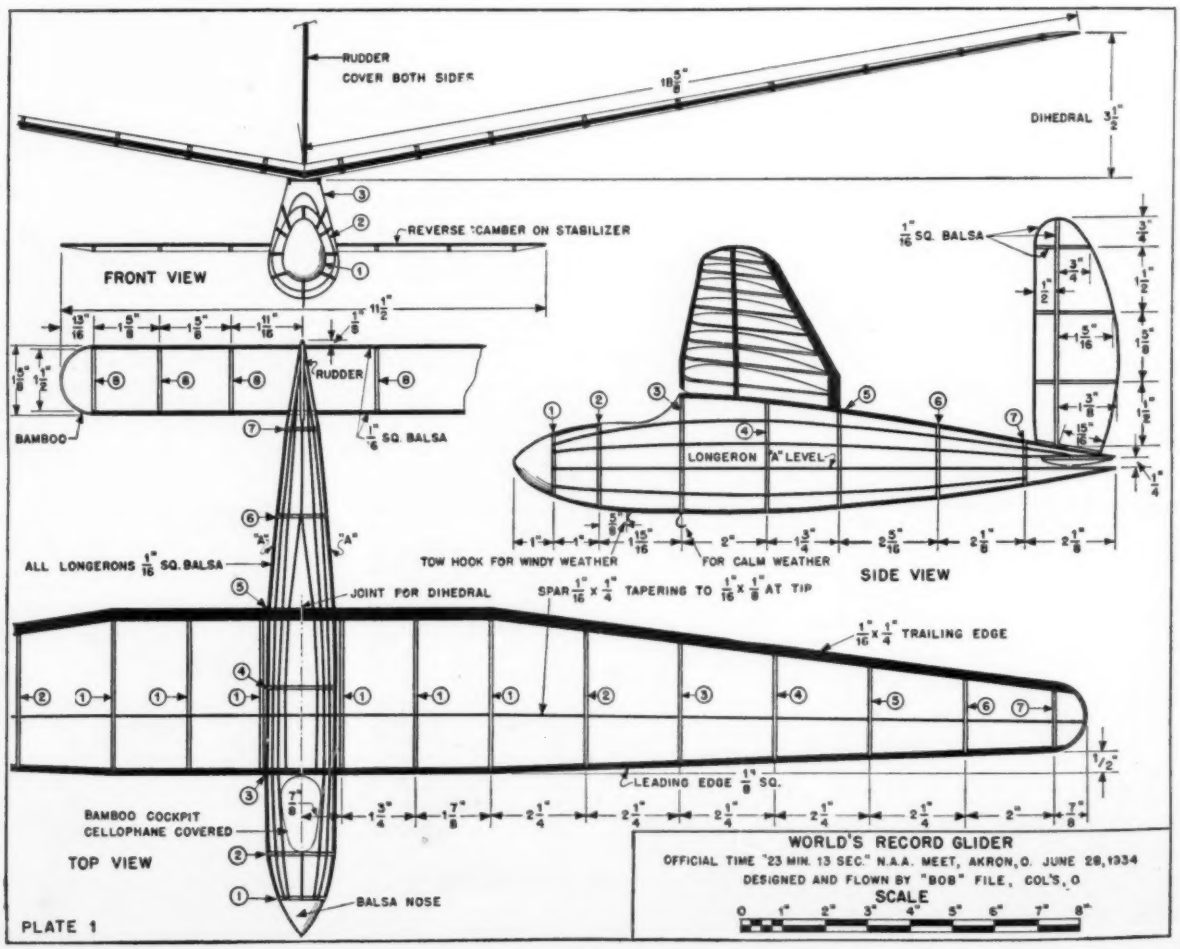
By ROBERT FILE

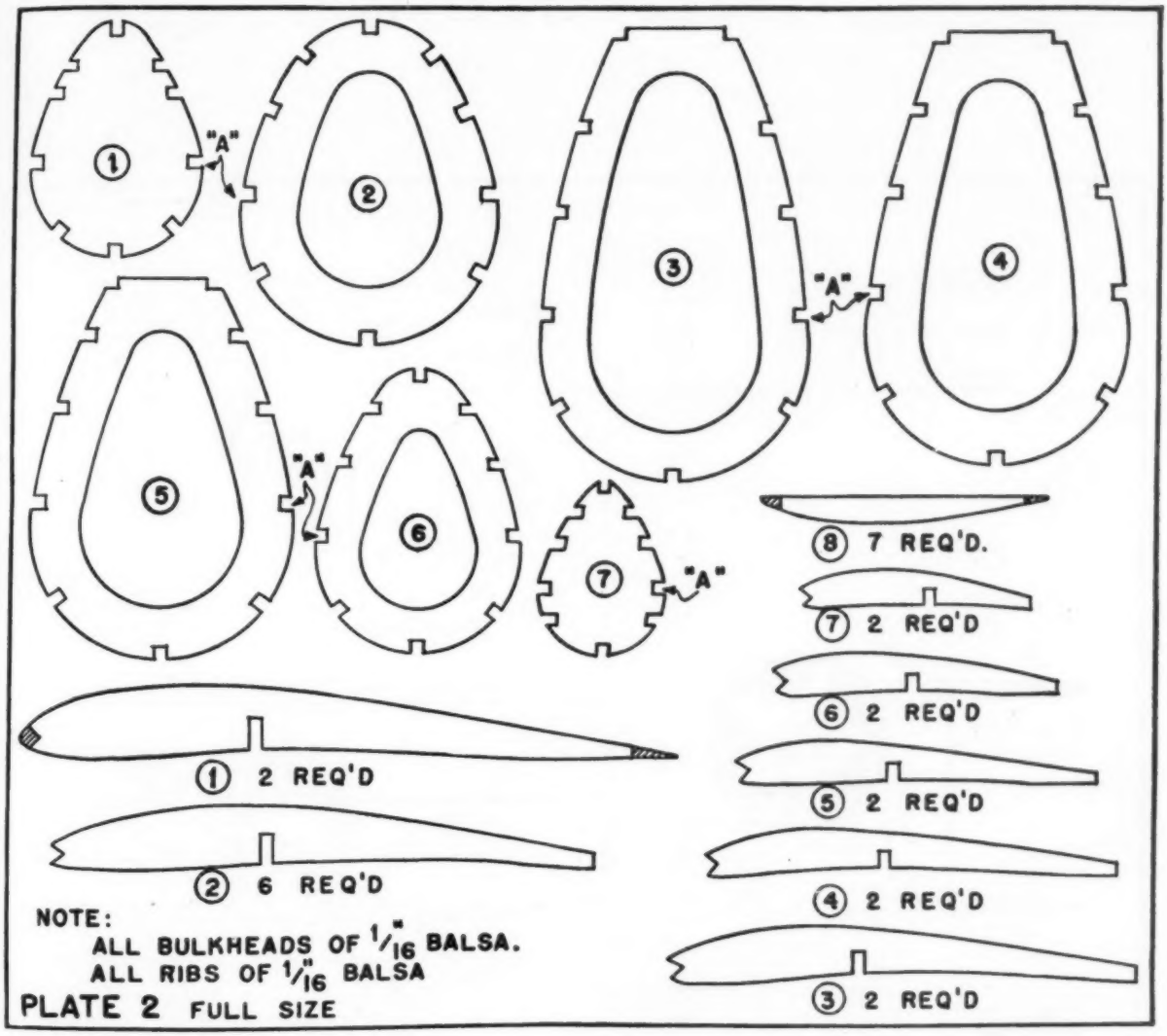
HERE are the plans for an easily constructed soaring glider that will give record-breaking flights consistently by carefully checking and following instructions, step by step.

In my estimation, no rubber-powered model can give you the thrill of a powerless glider riding the thermal air currents and rising almost magically to many times its original altitude.

In the course of several years of flying all types of model gliders, I have found this type to be the most consistent flyer as well as the most successful.

At the National Model Meet in Akron, this model made a new world's record of 23 minutes, 13 seconds by flying out of the judges' sight. The contest was held at the Municipal airport and I had noticed the only rising air currents were on the windward side of the huge Zepp's dock. In order to get these currents, the model would have to be towed close to the dock. However, there were two disadvantages in doing this. One was a limit of 100 feet on the towline and the other the weight rule. The model was towed up to about 80 feet and released where it was soon carried nearer the dock. At this point, as I had figured, the model started circling and rising fast and it was soon over the top of the dock but still in an upward current until it was at an altitude of about 500 feet. From there it started cross country to the far edge of the airport (about a mile and a half),





where it struck another thermal current from a ridge. That was all it needed, for it soon disappeared in the clouds.

The contributing factors on a flight like this are perfect balance, rising air currents and enough dihedral to keep the glider from slipping and losing altitude on the turns.

To get record-breaking flights, select a locality preferably hilly, as there are many rising currents from hills on a hot day. Use as much towline as possible (No. 50 thread), for the longer the towline the greater altitude you can get. I have often used 1,000 feet and it is possible to get 700 feet altitude, allowing for the slack in the line.

Now for the construction!

Fuselage

First, lay a thin paper over the bulkhead drawings, trace and cut out, laying the patterns directly on the wood. The easiest way to assemble this fuselage is by taking two pieces of 1/16" square balsa, the length of the fuselage, lay on the side view drawing and work on them the position of each bulkhead along longeron A. Bulkhead No. 3 should be glued in the proper slot by both longerons A. Then add bulkhead No. 4 and check on the trueness by the marks on these longerons. Next glue in Nos. 5, 6 and 7, leaving the longerons ends beyond No. 7 free until later. Then glue in No. 2 and finally No. 1. Now you have all the bulkheads in place on these two longerons. After this it is easy to add the remaining stringers. When you glue in a longeron on one side of the fuselage, always glue the corresponding one on the opposite side next. This keeps the fuselage from being warped.

Robert File with his glider at the "Nationals"

Wing

The wing is made in two halves, joined at the center. First cut out all ribs from 1/16" veneer and mark their numbers. Next cut a spar from 1/16" veneer, using fairly hard balsa. It is 1/16"x¼" at the center, tapering to 1/16"x⅛" at the tip. The wing can be built directly over the drawing or may be traced off. Make one-half of the wing at a time. Mark the spar for rib location and glue all ribs in place. While still pinned down, cut the trailing

(*Continued on page* 39)

The Le Pere Fighter

TO MANY who are authorities on the design of wartime aircraft, their choice of the finest looking, sweetest flying, high performance airplane will revert to the Le Pere Fighter. This ship was designed and built at old McCook Field in Dayton, Ohio, to the designs of Captain Geodfrey Le Pere of the French Aviation Mission in the United States, during the Spring of 1918.

This plane had a very wide range of performance and an extremely good top speed for wartime ships. The construction was of the usual plywood semi-monococque fuselage so popular at the time with wooden structure wings covered with fabric. The unusually clean lines of the plane were further enhanced by the "picture frame" interplane struts of built-up plywood. This obviated incidence cross bracing wires in the strut system. It also

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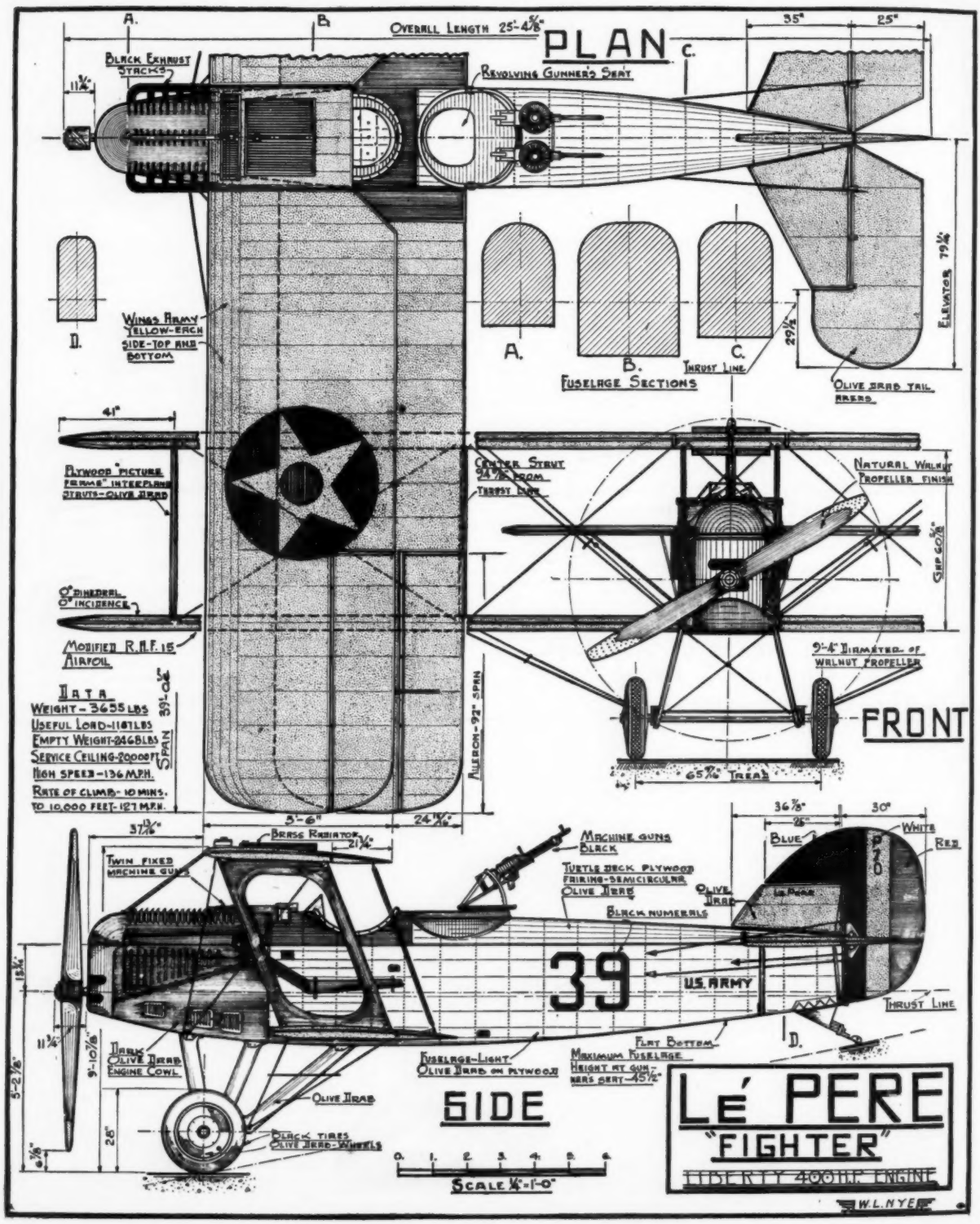
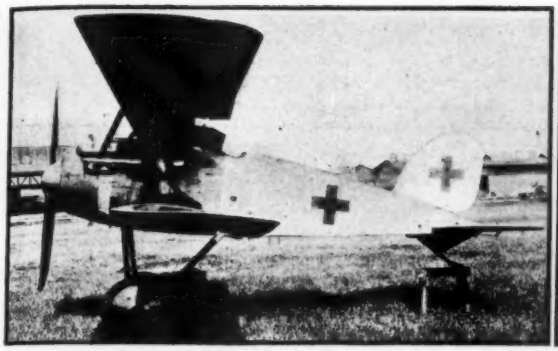




The Albatros D-10, (1917). Benz 195 h.p. engine

The Albatros D-11, (1918). Siemans Halske 160 h.p. engine

The Albatros Fighters on Parade

Part No. 5

How the Demand for Increased Speed and Performance Was Met With the Production of the D-10 and D-11 Types

By JOSEPH NIETO

JUST as the principal coach of a great football team might from his position back of the side lines, keenly observe each anticipated maneuver, fault or gain made by his two latest recruits in the most crucial play of his glorious career, and just before the last minutes of the final quarter in the closest intercollegiate contest of the season, senses that interception was not being carried out as he had planned, replaces the last addition in the line up with a player combining the best characteristics of the first two, who then goes crashing through an opening sweeping the field to a glorious victory; so it might have been with the "principals" of the Albatros-Werke in that last great "game" of 1917.

They keenly observed the performances of the D-7 and D-9, and in the final months of 1917, compared notes and decided to "send in" a combination of both types. The result was the rise of the Albatros D-10.

The L-40 or D-10 was produced in December 1917. This machine was distinguished among all the Albatros D-types owing to the fact that it was the first Albatros to employ the accepted 195 h.p. Benz 3vb engine as standard equipment. Up until that time, the Benz 3vb was not very well known in the Albatros realm and used only as an experiment in the D-7.

This engine consisted of 8 cylinders placed in two rows each in V-form, and was called a "speed type" especially since this same power plant was used in many pursuits of the following year.

Rumor has it that the Benz 3vb was copied after the "captures" of several Hispano-Suiza 220s standardized in the French Spad 13. Be that as it may, the Benz 3vb employed in the Albatros D-10 was intended to excel the Hispano in simplicity. The Benz people knew of troubles experienced with the earlier Hisso and set out to avoid such annoyances in the perfection of their 3vb.

At 1700 revolutions per minute, this engine developed a maximum of 225 horsepower. The stroke was 140 m.m. and the bore 125 m.m. Consumption of benzine was 215 grams per horse-power, per hour at full speed, an approximate total of 12.093 Imperial gallons per hour, which was considered economical on fuel for an engine of this type. The weight of the Benz 3vb with water and oil was approximately 690 lbs.

This engine experimentally used in the D-7, made it a fast but heavy ship, yet as it proved more desirable than the 160 h.p. Mercedes, used in the D-9 light plane, it was accepted as standard equipment in the D-10 with body construction of the D-9.

By using the new Benz 3vb engine in the D-10, the casing at the nose and construction of the engine bed was different than previously in the D-9, on account of differences in the forms of the previously employed Mercedes and the newly installed Benz.

The fuselage construction of the Albatros D-10 was the same as that of the D-9 with exceptions at the nose which in this instance had a slight hump between and just ahead of the engine banks, presumably the covering of the reduction gear of the engine.

Below this unusual "growth" in the form of the nose, the cross section of the nose disc was round like the D-7 and D-5 models, conforming with the large spinner connected at the root of the propeller. With the exception of the small hump located just ahead of the engine banks, the foremost part of the nose of the D-10 had a strong likeness to that section of the D-5a. The effectively streamlined plating attached around the engine including the hump supposedly covering the reduction gear, was the only metal covering throughout the body of this machine. This plating was screwed on to the nose formers and fastened to the plywood sides of that section in a method practical for quick removal in an inspection.

The streamlined metal casings covering the engine banks also presented improved forms in comparison with the D-7. These were curved in their forms and open at the front, provided with reversed flanges allowing an adequate supply of forced air to pass the length of the cylinder heads on both sides. The rest of the fuselage was practically the same as the D-9.

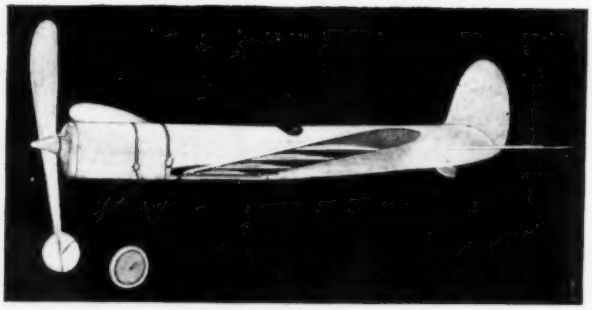
The wings of the D-10 were more or less the same as the D-9 with the exception of the retained D-7 airfoil and certain features which were characteristic in famous racing biplanes of later times. The radiator of conventional design was placed as usual in the mid-wing section.

Here is a picture of the rare Pfalz-Kampfeinsitzer, type D-8 with a 160 h.p. Siemans-Schuckert engine

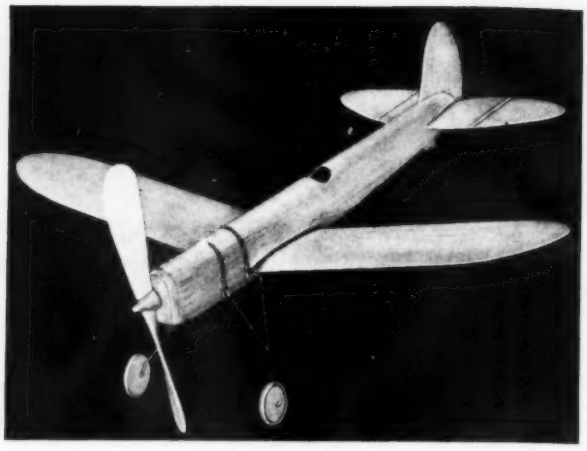
One of the most notable features was the reduction of air resistance in the new forms of the ailerons. These were compensated with streamlined leading edges and knife-edged trailings. The measurement of the airfoil in the direction of the air currents was minimized and was deeper than in previous designs. External or exposed control cables were entirely eliminated, as the ailerons of this machine were controlled by the same internal rod device featured in the Albatros triplane.

The most important fea-

(*Continued on page* 40)



The finished model with its adjustable and flexible landing gear is extremely durable as well as graceful



Fundamentals of Model Airplane Building

How You Can Build a Realistic and Durable Balsa Fuselage Model With Exceptional Flying Qualities. A Complete Course in Model Building. Part No. 10

By EDWIN T. HAMILTON

THIS is the first model to resemble a real plane that has been designed by Charles H. Grant for this series. It is the finest example of all-balsa construction that the writer has ever seen and one which can safely be guaranteed to please the most expert in the field as well as the beginner. Weighing only a little over two ounces, it nevertheless has the appearance of an extremely heavy ship. While not of the "featherweight" class and being of all-balsa construction, the model has turned in some remarkable flights. Hand-wound, it will cover a distance of 600 feet, while the use of a winder will increase this to 1000 feet.

Another designing feat incorporated in it is the fact that it can be converted into a speed model with little trouble. Equipped with a propeller of eight or nine inches and surplus rubber, this model can be expected to break fuselage model speed records.

It has a perfect take-off and a smooth general glide, while stability, power, climb and general airworthiness are so apparent that they seem to have been "built in" in the model.

Fuselage

The fuselage consists of a sheet of balsa wood bent in the form of an inverted "U" with supporting stringers, bulkheads and brace blocks. Study the accompanying plan carefully. The fuselage "stretch-out" has been shown on graph to help the builder in cutting out this sheet. Take a large piece of paper and rule it with ¼" squares, as shown in the graph plan. On this sheet, lay out the fuselage as shown in the plan under "Fuselage Pattern."

The fuselage is made of 1/32" sheet balsa of medium weight. If this cannot be obtained, 3/64" sheeting should be sanded down to 1/32" thickness. Do not use heavyweight balsa, nor the very light wood, as the one will add too much weight and the other will not be strong enough. Trace your copy of the stretch-out on the balsa sheet with carbon paper. The sheet is now cut out.

After completing the outline, cut out the cockpit hole and the elevator slots, but do not cut the wing slots at this time. Finish all edges smooth with fine sandpaper. The four bulkheads are now cut out. These are shown at the top of the plan by "A", "B", "C" and "D". The front bulkhead "A" is cut to shape from ¼" thick balsa and finished with a ¼" hole located as shown in the plan.

Both "B" and "C" bulkheads are of 1/16" thick balsa and have ½" holes cut in them. The trailing end bulkhead "D" is of 1/16" balsa and has a hole cut in it for the end hook, as shown in the plans under "Side View." When all these have been properly cut out and sanded smooth, the fuselage must be properly bent.

Soak the sheet balsa in hot water and slowly bend it to proper shape. The bulkheads may be used from time to time as templates. Slip a scrap piece of 1/32" balsa into the elevator slots and push it forward to the leading ends of these slots. While the fuselage is drying, see that its edges stand on any level surface and that weights hold its sides parallel to each other. When in this position, see that the scrap balsa piece in the elevator slots remains level and parallel to the level on which the fuselage rests. Allow it to dry in this position.

When dry, the reinforcements of the fuselage are added. Along the entire length of the fuselage on the inner side of its edges, a 1/16" x ¼" stringer is cemented on each side, as shown in the plan under "Section B-B." These stringers are the reasons for the bulkheads being slotted at both corners of their base, as shown in the plans.

When these have been cemented in place, two additional sheet balsa supports are cemented to the inner sides of the fuselage. These are shown in the plans in dotted lines under "Side View." They are of 3/64" balsa and extend from ¼" in from the front, back a distance of 11¼". They are cemented on top of the two stringers just added against the inner walls of the fuselage. They can be seen quite easily in the plans under "Section A-A."

The front bulkhead "A" is now cemented in place, as shown in the plans. Its front face must be flush with the front edges of the fuselage. Apply cement to all edges that touch the fuselage, place it in position and hold the walls of the fuselage with

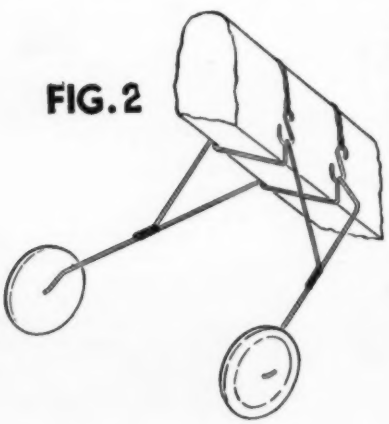


FIG. 2

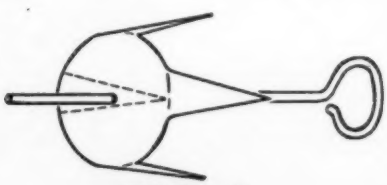
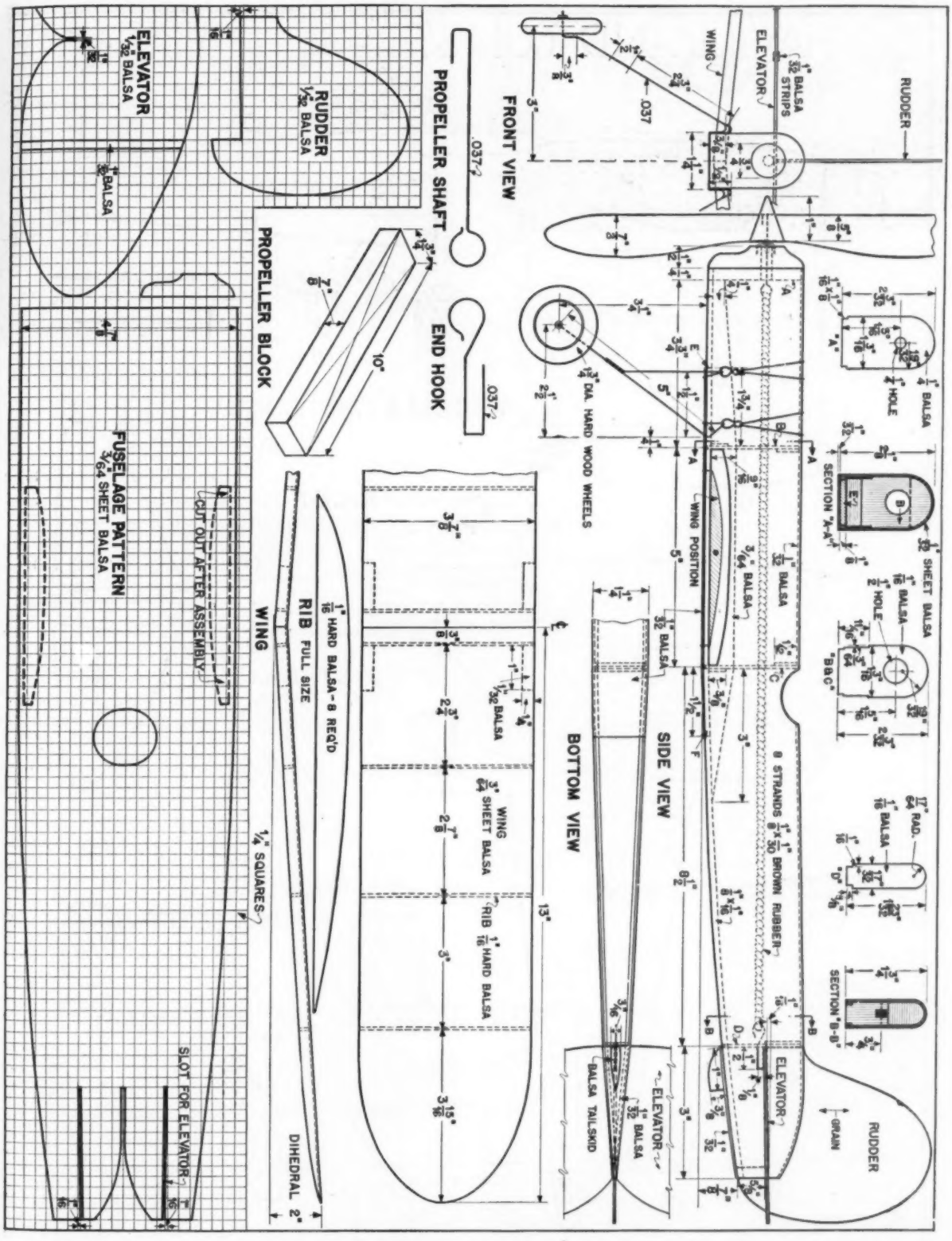
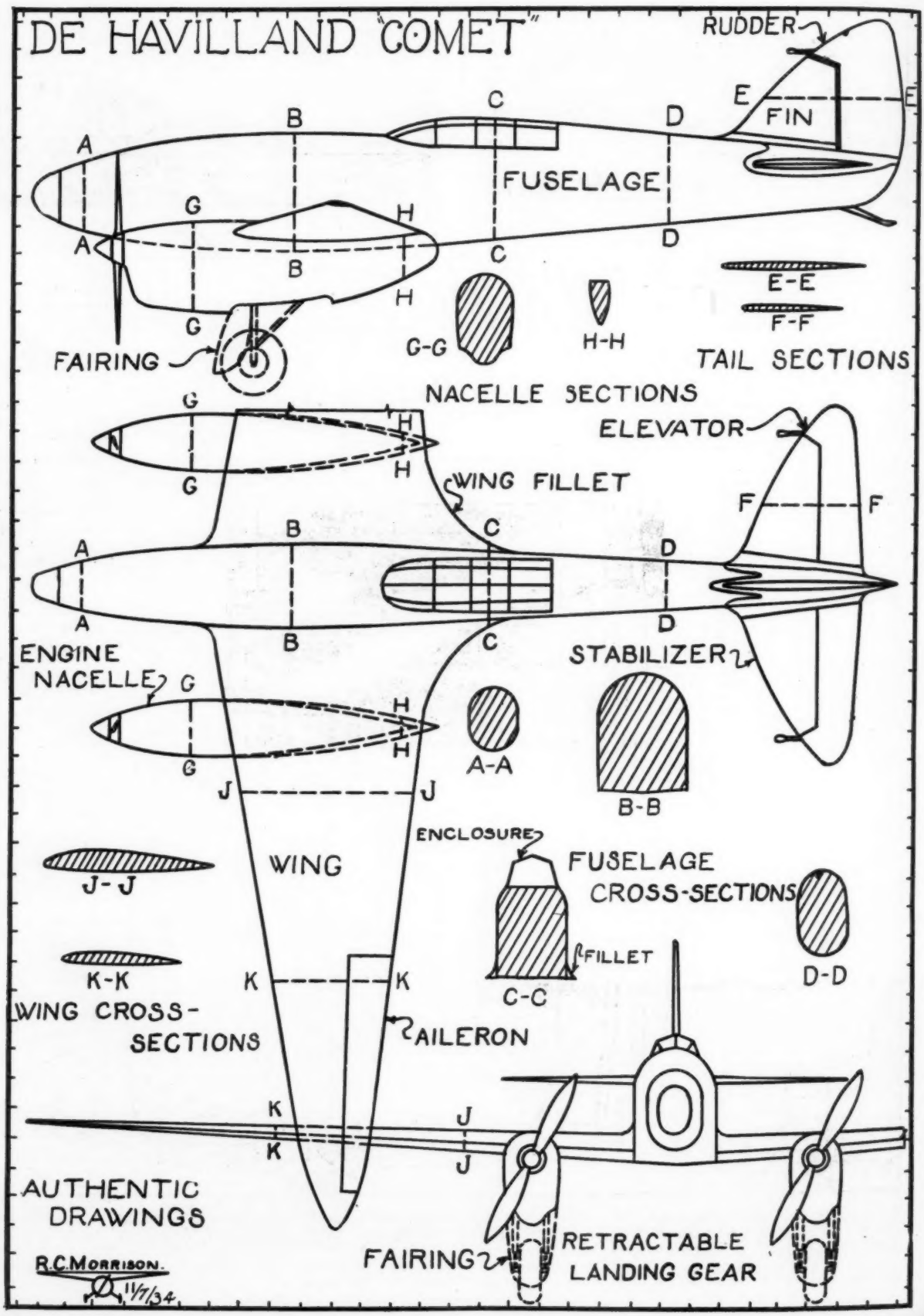


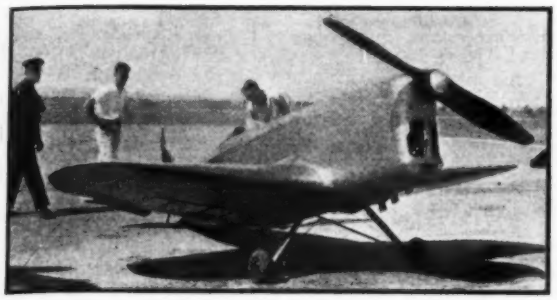
FIG. 1



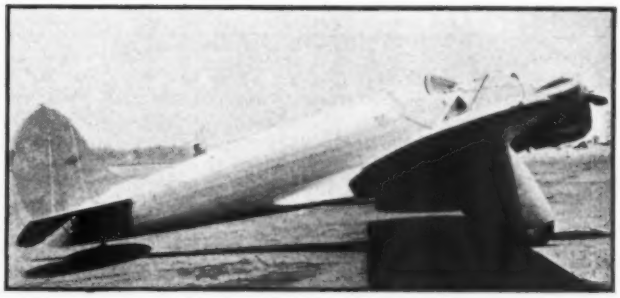
model pins until dry. Test bulkheads "B" and "C" to see that the notches in their straight sides fit the stringers and sheet supports on the fuselage perfectly. These are then cemented in place, as shown in the plan and the walls held tightly against them until the cement is dry with model pins.

Bulkheads "B" and "C" are reinforced at their tops and bottoms by 1/16" thick balsa pieces. These can be noted in the plans under "Side View" where they are shown in dotted lines against the bulkheads. The top ones must be cut to match the upper curved *(Continued on page 44)*


DE HAVILLAND "COMET"
RUDDER
FIN
FUSELAGE
FAIRING
G-G
H-H
E-E
F-F
TAIL SECTIONS
NACELLE SECTIONS
ELEVATOR
WING FILLET
STABILIZER
ENGINE NACELLE
A-A
B-B
J-J
WING
ENCLOSURE
FUSELAGE CROSS-SECTIONS
FILLET
C-C
D-D
K-K
WING CROSS-SECTIONS
AILERON
AUTHENTIC DRAWINGS
R.C. MORRISON.
11/7/34
FAIRING
RETRACTABLE LANDING GEAR



The Burrows R-5 racer with a 12-foot wing span



The new two-place Kinner B-5 sportplane

On the Frontiers of Aviation

New Planes That Lead the World—How to Build Solid Models of the DeHavilland Comet and the Bellanca Racer

By ROBERT MORRISON

THIS month good news comes in from all directions. The Bellanca Aircraft Corporation has announced the production of a new plane. It will be a commercial version of Col. Fitzmaurice's low-wing racer. The new plane will be unsurpassed as to speed, capacity, price and performance.

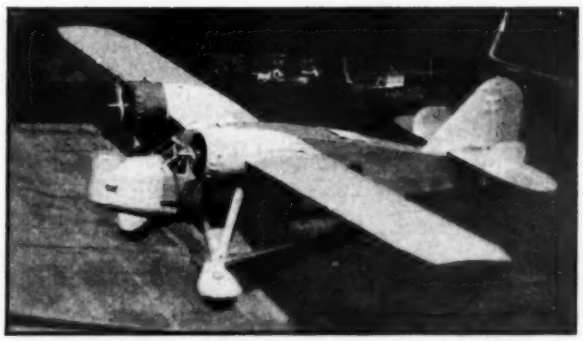
Another new Bellanca of which most of our readers may already be familiar, is the twin-engined bomber built for South America. This plane is an innovation of the famous Bellanca Airbus and Aircruiser. The engines are installed in nacelles in the upper wing and a gun turret is located in the nose of the fuselage. Following is the performance of the bomber:

Top speed.....190 m.p.h.
Cruising speed.....172 m.p.h.
Stalling speed.....58 m.p.h.
Climb to 3280 ft.....2.7 min.
Climb to 6560 ft.....5.5 min.
Rate of climb per min.....1200 ft. per min.
Service ceiling.....23,500 ft.
Absolute ceiling.....25,000 ft.
Normal range.....710 miles
Maximum range.....1500 miles

General Aviation's new GA-38 is 70 percent completed as we go to press. Work has been progressing slowly on it as no definite orders have been received on the large 14- to 20-place metal low-wing transport at the present time.

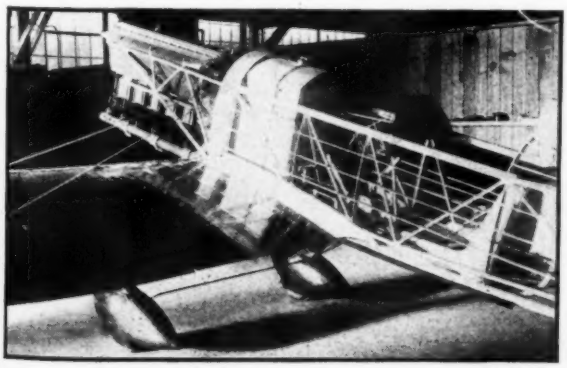
Calculated performance and specifications follow:

Wing loading.....18.54 lb./sq. ft.
Power loading.....10.23 lb./actual h.p.
Length over all....59 ft. 8⅛ in.
Height over all.....15 ft. 10 in.
Span over all..76 ft. 7 7/16 in.
Power plant P & W S1D1-G
550 h.p. Wasp geared
Pay load.....3400 lb.
High speed.....
.....218 m.p.h. at 8000 ft.
Landing speed.....64 m.p.h.
Service ceiling.....26,410 ft.
Absolute ceiling.....28,230 ft.
Range .....1240 miles
at 8000 ft. (62.5% power)

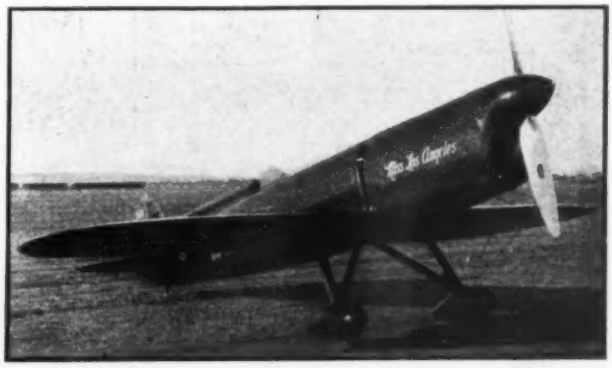


The Bellanca bomber which has a speed of 190 m.p.h. and a pay load of 5000 lbs. It climbs with one motor

The successful performances of Roy Minor's "Miss Los Angeles" and Lee Miles' Miles and Atwood racer at the 1934 National Air Races, has encouraged Lawrence W. Brown, their builder, to construct numerous other high-speed planes. The Lawrence W. Brown Aircraft Company has completed plans for a plane almost an exact duplicate of the "Miss Los Angeles," but with minor improvements. A slightly larger wing area will be employed. The plane has been designed for our military air forces as a pursuit ship! Two 30-caliber machine-guns are to be mounted on it and it is to have a top speed of 220 m.p.h., though it only has a 300 h.p. engine! This performance



The unusually light framework of the Brown "Special"



The Brown "Special" which shows a speed of 280 m.p.h.

is almost equal to the more high-powered pursuits throughout the world.

The Brown pursuit will cost less than one-third the cost of our present pursuit planes. Such a small plane as the Brown will be difficult for the enemy to "spot" in the air and its extraordinary stability, agility and maneuverability will undoubtedly prove the ship's worth as a pursuit plane. A Menasco Buccaneer will be the power plant. Though the new pursuit is designed directly from a fast racer, it has all the requirements of safety for pursuit planes. Landing flaps are employed, which is one of the plane's most important safety features.

The Brown Aircraft Company is also working on a racer somewhat larger than the "Miss Los Angeles." The plane is now being groomed for an attempt at the world's landplane speed record made by the late Jimmie Wedell. Of course it will have a more powerful engine than the "Miss Los Angeles." We hope that experiments with the ship will be more successful than the Kieth Rider MacRobertson entry which crashed, killing the famous Jim Granger, its pilot.

Now that the MacRobertson Race has been such a success, many other long-distance races have been proposed. France is planning one from Paris to Indo-China, and of course we Americans could not be outdone and have decided to stage a free-for-all plunge around South America and Canada, touching the Pacific and Atlantic coasts of the United States. If enough money is put at stake and enough time allowed for the construction of special racing planes, we will see many of them.

The majority of racing planes built especially for the MacRobertson Race were unfortunately not successful, mainly because of lack of time to thoroughly test them. The Airspeed Viceroy, which is very similar to the Envoy, would have been well up among the winners if it had at first been "broken in" and all the "bugs" taken out of it.

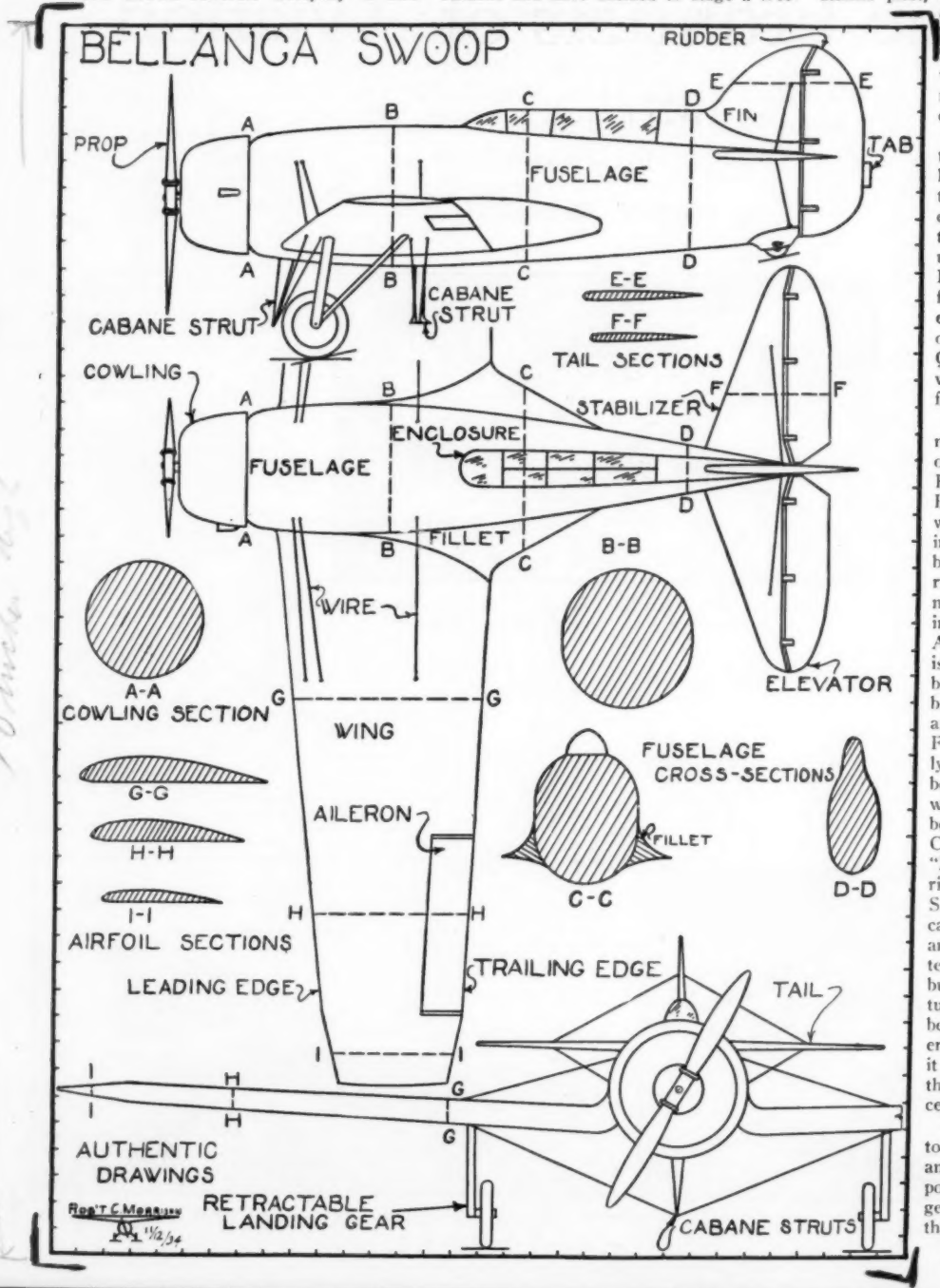
It was very disappointing that the Italian pilot, Lombardi, was not able to compete with his specially built Bergamaschi. The ship is of excellent design and is very similar to our Bellanca racer. Undoubtedly it will compete in future races.

It is also disappointing that Jacqueline Cochrane lost her specially built Northrop racer in a bad accident and was forced to fly the Q.E.D., which had not undergone sufficient tests. Recent reports are to the effect that the Roumanian government has purchased an option for constructing the Q.E.D. as a military ship, which should prove successful.

Probably everyone is familiar with the controversy over the elimination of the Bellanca of Col. Fitzmaurice. But whether the English were right or wrong in eliminating it, it would not have been able to compete in the race, anyway, because of minor troubles that occurred in later attempts to fly to Australia. The latest word is that the Bellanca racer is back in the United States being thoroughly overhauled and tested, and then Col. Fitzmaurice will undoubtedly attempt the London-Melbourne trip and show the world how the route should be flown. The Bellanca Company calls the plane the "Flash," but Col. Fitzmaurice has named it the "Irish Swoop." In England they call it the "Shamrocket," and now after its many attempted flights to Melbourne, but with each attempt it returned to London, it has been nicknamed the "Boomerang." Let the British call it what they may, but nevertheless the ship has many exceptionally fine qualities.

Mr. Bellanca has been able to use a thin wing section and still be able to incorporate a retractable landing gear on the plane, a feature that has not been common in

(Continued on page 37)



More About Microfilm

An Expert Builder Tells You Many Secrets About the Latest Methods of Making and Using Microfilm

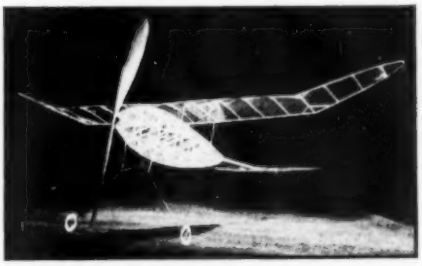
By HERBERT GREENBERG

PREVIOUS articles in UNIVERSAL MODEL AIRPLANE NEWS have explained the methods of manipulation with microfilm, but the purpose of this article is to present some useful information concerning the preparation of microfilm solutions.

It may not be amiss at this point to explain that microfilm is the name coined by model airplane builders for that light, transparent covering. It has been in use for many years in the study of optics and it also serves as a membrane for experiments with osmosis—the mixing of two liquids or gases by passage through a porous wall separating them. It was not until recent years, however, that microfilm was first used on model airplanes as a substitute for the much heavier material, paper. I am proud to say that I was one of three model builders who introduced microfilm for the first time at a national contest—the meet held at Atlantic City in 1932. No sensational time was made by any of these models, and microfilm, consequently, was considered just novel. It is only natural that if one builder is very successful with a model, design, or idea, other builders are sure to copy. This fact was proven after Herbert Owen of New Britain, Conn., broke the R.O.G. world's record with a microfilm ship. The flight was made at the Eastern States Indoor Meet held in New York City in December, 1932. Between this date and June, 1933, model builders worked and experimented at a feverish pitch in order to produce a film that could be applied to a model successfully, for use at the national contest in June.

Since that date, great progress has been made in the development of microfilm and a few good solutions have made their appearance. Most builders have been content to spare themselves the so-called trouble of preparing their microfilm solution by purchasing it from model supply houses, but there are still some fellows who have the initiative and ambition to experiment and develop their own. It is for these fellows who have had some difficulty in preparing their solutions, that this discussion is intended.

The one fact that must always be kept in mind is that microfilm solution is a lacquer and the chemistry that applies to lacquers also applies to microfilm solutions. Every lacquer consists of three essential ingredients; namely, a base which is the body of the lacquer, a solvent which dissolves the base, and a plasticiser, which makes the solution flexible. Ordinary commercial lacquer, however, contains either too much solvent or too little plasticiser, besides gums and resins that are objectionable for use in microfilm solutions. Consequently, a solution containing only the three essentials must be prepared.



A beautiful microfilm covered commercial built by John Young and flown at the 1934 National Contest for a duration of more than twelve minutes. The flight was only a few seconds less than the winning flight of a similar model by the author. Note the paper cross strips cemented to the microfilm covering the fuselage. These take the twist of the rubber. This idea was originated by John Young

If the base were a liquid, could be spread on water, and were flexible, neither a solvent nor a plasticiser would be required, but this is not the case. The base that is used in lacquers is nitrated cotton or pyroxalin, formed by adding ordinary absorbent cotton to a mixture of hot nitric and sulphuric acids, letting the mixture stand for a reasonable length of time; and then washing the cotton free of the excess acid. The lacquer manufacturer receives this nitrated cotton and proceeds to dissolve it, but pyroxalin may be purchased already dissolved. The best pyroxalin bases are collodion and airplane wing dope.

Collodion, if used as a base, should be of the plain rather than of the flexible variety, for the latter contains castor oil, which, though it renders the film flexible, makes it tacky also. Collodion is the purest form of dissolved pyroxalin that may be obtained for it contains no benzine, tuolol, or butanol resins which are used in lacquers to obtain a gloss, and as substitutes for expensive solvents, but which also make the film sticky, and if used in excessive amounts also leave pinholes in the film. It is for this reason that many of the successful microfilm solutions on the market contain collodion.

Airplane wing dope is not nearly as pure as collodion for it contains about thirty-two percent of benzol, which is somewhat objectionable in solution. Nevertheless, good films have been obtained using airplane wing dope as a base, but I believe that collodion will soon entirely eliminate dope from use in microfilm solutions.

A previous article has recommended the use of bronzing liquid as a base. After experimentation with this substance, I cannot see how anyone could suggest it for use as it produces a very tacky and weak film. Another substance that should be avoided is banana oil. It has the same properties as bronzing liquid.

As mentioned before, the solvent serves to dissolve the base and enable the film to spread on the water. A good solvent will hold a large amount of pyroxalin and still maintain a manageable fluidity. The best solvents for the purpose are ethyl acetate, butyl acetate, ammyl acetate, acetone and ethyl lactate. According to good authority, ethyl acetate is the best solvent. Acetone has the property of turning the film milky.

It must be remembered that in compounding a microfilm mixture, very little solvent need be used as the base is already dissolved. Usually ten to fifteen drops of solvent are sufficient for each ounce of microfilm solution. If too much solvent is added, the film will be oily, will take long to harden on the water, and will contain many holes so that it will be useless.

When collodion first was applied to cuts and scratches as a protective sheath, it was noted that the film contracted and puckered on drying. This property was undesirable in view of the pain caused. To overcome this, the collodion was plasticised by camphor, Canada balsam, and castor oil, and flexible collodion resulted.

In selecting a plasticiser, pay attention to its power of imparting flexibility without softening the film, reducing its tensile strength, or making the film too sticky. It is possible by using the correct solvent in combination with a good plasticiser to get a film that is absolutely dry and flexible and which does not weaken the film to an appreciable amount. The best material for effecting this object is tricresyl phosphate. This remarkable substance, when dissolved in a solvent and added to the base, produces a clear, homogeneous film which is not tacky under any reasonable proportion of the two components, and has more plastifying effect per ounce than castor oil. Other excellent plasticisers are dibutyl phthalate and camphorated oil.

After deciding on the constituents of the microfilm mixture, (an excellent solution consists of one-half ounce of collodion, eight drops of ethyl acetate and about eight drops of tricresyl phosphate), the actual preparation must be considered. I usually prepare half an ounce at a time, as such a quantity will make many sheets. The bottle in which the solution is to be prepared is filled almost halfway with the base. The solvent is then added in the specified amount (ten to fifteen drops per ounce of solution), and the bottle is capped and shaken. The amount of plasticiser to be added is best determined by actual ex-

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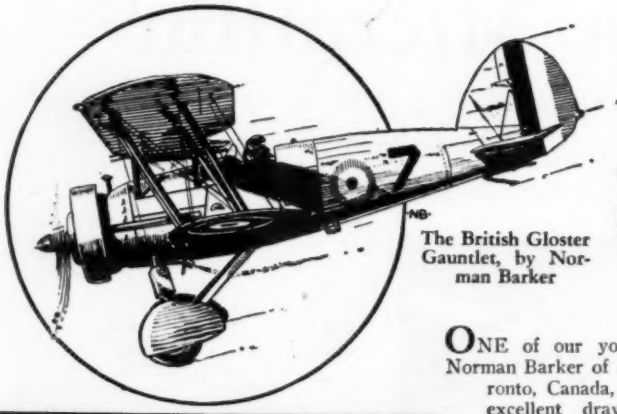


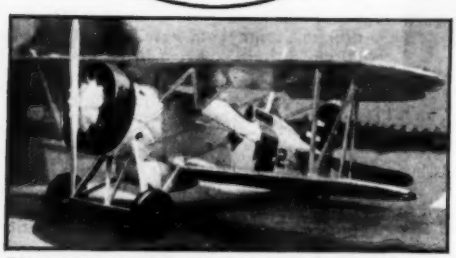
The British Gloster Gauntlet, by Norman Barker

AIR WAYS
HERE AND THERE

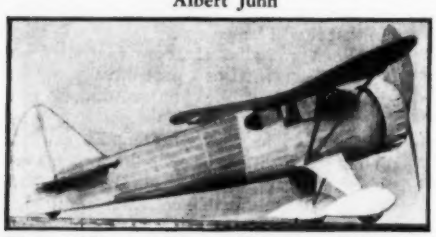
What Readers Are Doing to Increase Their Knowledge of Aviation in All Parts of the World. Send Pictures and Details of Your Experiments

ONE of our young Canadian friends, Norman Barker of 139 Evans Avenue, Toronto, Canada, has contributed a very excellent drawing of the Gloster Gauntlet, which adorns the top of this page. Many fine drawings have come to our office; however, we can print but a very few of them. We hope that this fact will not discourage many of our budding artists.

The finest photograph that we have received this month has been sent in by Albert Juhn of 214 West State Street, Salem, Ohio. It is a Boeing F4B-4, shown in picture No. 1. Close examination will reveal careful adherence to details. It has movable controls operated from the cockpit, removable belly tank, upholstered pilot's seat, safety belt, and wing walks. Not only is Juhn's model an excellent piece of work, but the photograph is exceedingly fine as well.



Picture No. 1. The best picture this month. A Boeing scale model of fine workmanship, by Albert Juhn



Picture No. 2. George Thompson built this flying scale "Mr. Mulligan" for Ben Howard

George Thompson of 5414 East 25th Street, Kansas City, Mo., has been building a detailed flying scale model of the new "Mr. Mulligan" for its designer, Ben Howard. It is shown in picture No. 2. It is a very nice-looking job and flies very well. Evidently Mr. Thompson is making good use of his genius in a business way. Many model builders put their art to good use by building models for commercial purposes when they have the business.

Picture No. 3. Albert Primeau with his "gas job" and a rubber-powered scale model

The gas model bug has finally arrived in another state, Louisiana. Albert Primeau of 205 Sixth Street, Lafayette, La., is the victim. He has constructed a very nice-looking gas job which is shown in picture No. 3. Another model of 40-inch wing span is shown to the right of the gas job. Mr. Primeau is shown in the picture presiding over his "offsprings." He says that the gas job has made some excellent flights. It has a 7-foot wing span and weighs 6 pounds. We hope to see Mr. Primeau at the next National Contest with his ship.

Bill Hiering of 705 Ocean Avenue, Seaside Park, N.J., is an excellent photographer, as shown by picture No. 4. He takes great pleasure in building models of wartime planes and posing them so that they represent planes in actual combat. Here we see the pilot of a Nieuport saving the pilot from a flaming Camel. This stunt may be actually possible but I doubt if there are many who would care to try it for pleasure. The picture is indeed very realistic, even the clouds may be seen in the background. Mr. Hiering does not tell us what he uses to represent smoke. He has sent us several other very interesting pictures which we are unable to publish because of lack of space. More pictures of this nature will appear in other issues.

Some time ago UNIVERSAL MODEL AIRPLANE NEWS published plans for a Russian Fighter. These plans were the first ones to be published of a Russian airplane in any magazine in this country. Mr. George Linberts, Jr., of 506 Grove Street, Fort Atkinson, Wis., sends us picture No. 5, showing a model which he has built from these plans. It is a very nice-looking job and looks very businesslike with its machine-guns. Linberts is only 13 years old. He says that the plane has made some very fine flights.

Joseph Coti of Gananoque, Ontario, Canada, became interested in building model autogiros some time ago. One of his productions, for which he had great hopes, is shown in picture No. 6. In order to have it successful, he built it closely to scale. However, like many other scale models, it refused to fly. He therefore posed it in a very natural manner to give it the effect of a large ship coming into a landing. One could easily mistake it for the real thing

Picture No. 5. A flying scale model of a Russian Fighter, a rare ship, by George Linberts, Jr.

Picture No. 8. George James built this model Pietenpol gas job to exact 1/4 scale

Picture No. 15. A successful gas job built by members of the Glen Ellyn Model Club

Picture No. 4. A "shot" of a model mid-air rescue by Bill Hiering

in the picture. The rotor span is only 26 inches.

To show that Joseph Coti can actually make models that fly, we have published picture No. 7, which shows one of his models, a Sopwith Dolphin, "going places." This picture is one of the most realistic flight pictures we have received. This plane won two prizes for its builder in a contest at Kingston, Ontario, airport. Coti says it is one of the finest fliers he has ever built.

Picture No. 8 shows an exact scale model of a Pietenpol Air Camper. It is built only of balsa wood to one-quarter scale. It even boasts of rubber tires. At present its builders, George James and George Marsh of 1002 Franklin Avenue, Wilkinsburg, Pa., are waiting impatiently for its power plant, a small gasoline engine, to arrive. When the motor is installed test flights will be made, pictures of which they promise to send as soon as possible.

Another young man has become interested in gas models. It seems to be taking the country by storm. He is Floyd Steinberg of 804 Louisa Street, Flint, Mich. The ship which he has designed and built is shown in picture No. 9, together with two of his smaller ships. The gas model has a span of 6 feet, 10 inches, and weighs 3½ pounds, minus the covering. Balsa, pine and maple were used in the construction. Casco glue was used to join the parts. You will have to look closely at the picture in order to see the miniature P-6-E Hawk, built to a scale of one-half inch to a foot. This little ship is complete in every detail and is entirely a built-up job. It has machine-guns, filed aluminum prop, radio, first aid kit, rubber grip on the end of the stick, aluminum wheel hubs, home-made rubber tires, filed aluminum tail wheel fork. All radiators are honeycombed. It has a span of 15¾ inches. Steinberg tells us that only raw material was used in its construction. We wish to commend him highly and we think it is a swell job from what he tells us, for the picture is entirely too small to judge its merits by examining it carefully.

The little airplane on the right is a ship of his special design. It has a span of 30 inches. Steinberg tells us that it flies better than many monoplanes that he has seen. It weighs 2 ounces. The following is hard to believe, but we feel Steinberg is a truthful young man. He says that he has made 200 consistent flights with this ship and that it is almost 3 years old.

Picture No. 9. Floyd Steinberg is versatile in respect to the type and size of ships he builds. Here is a small detail scale P-6-E, a flying scale model and a "gas job" by him

Picture No. 10 shows a group of gas model experts assembled at the Kresge Contest held in October at Newark Airport. We are indebted to Bill Effinger for the picture. He is shown with his job, an exact model of the Buhl Bullpup, at the extreme right. This little ship is an excellent flier and has attained an altitude of 2,000 feet at various times. On one occasion, the wing crumpled while it was in a dive and spun into a crash in a very realistic manner. This provided one of the greatest thrills of the contest.

Picture No. 11. Kenneth Diget with his scale Monocoupe which has won many trophies for him

Picture No. 12. The Australian Wakefield trophy which stimulates interest in that country

Picture No. 11 shows one of our foremost model experts, Kenneth Diget of 45 Groveland Street, Battle Creek, Mich., holding a contest scale model of a Monocoupe. On the right is the trophy which was awarded him in the 1933 National Contest, in which he placed second. This model has also won him two places at the National Air Races at Chicago (we do not mean to infer that he flew this model in the contest. It was entered in the scale contest), first place at the American Legion National Contest at Indianapolis, and sixth at the National Contest at Akron. It seems that this model has had quite a history and it has certainly brought its builder considerable glory.

Picture No. 10. A line up of gas models at the Kresge contest. They all performed well

MODEL NEWS FROM OTHER COUNTRIES

In order to stimulate model competition in Australia, a permanent Wakefield Trophy has been established there by the Model Flying Club of Australia.

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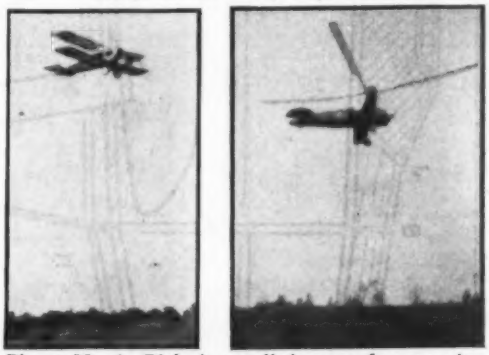

Picture No. 6. Right is a realistic snap of an autogiro pursued by a Sopwith Dolphin (Pict. No. 7), by Joe Coti. One is posed, which one is flying?

Picture No. 14. A few of the winners at a recent contest held at Los Angeles Airport (Courtesy Bunch Model Company)

Picture No. 13. Models at a recent M.F.C. exhibition in Australia. At the right is an unusual D. H. Transport

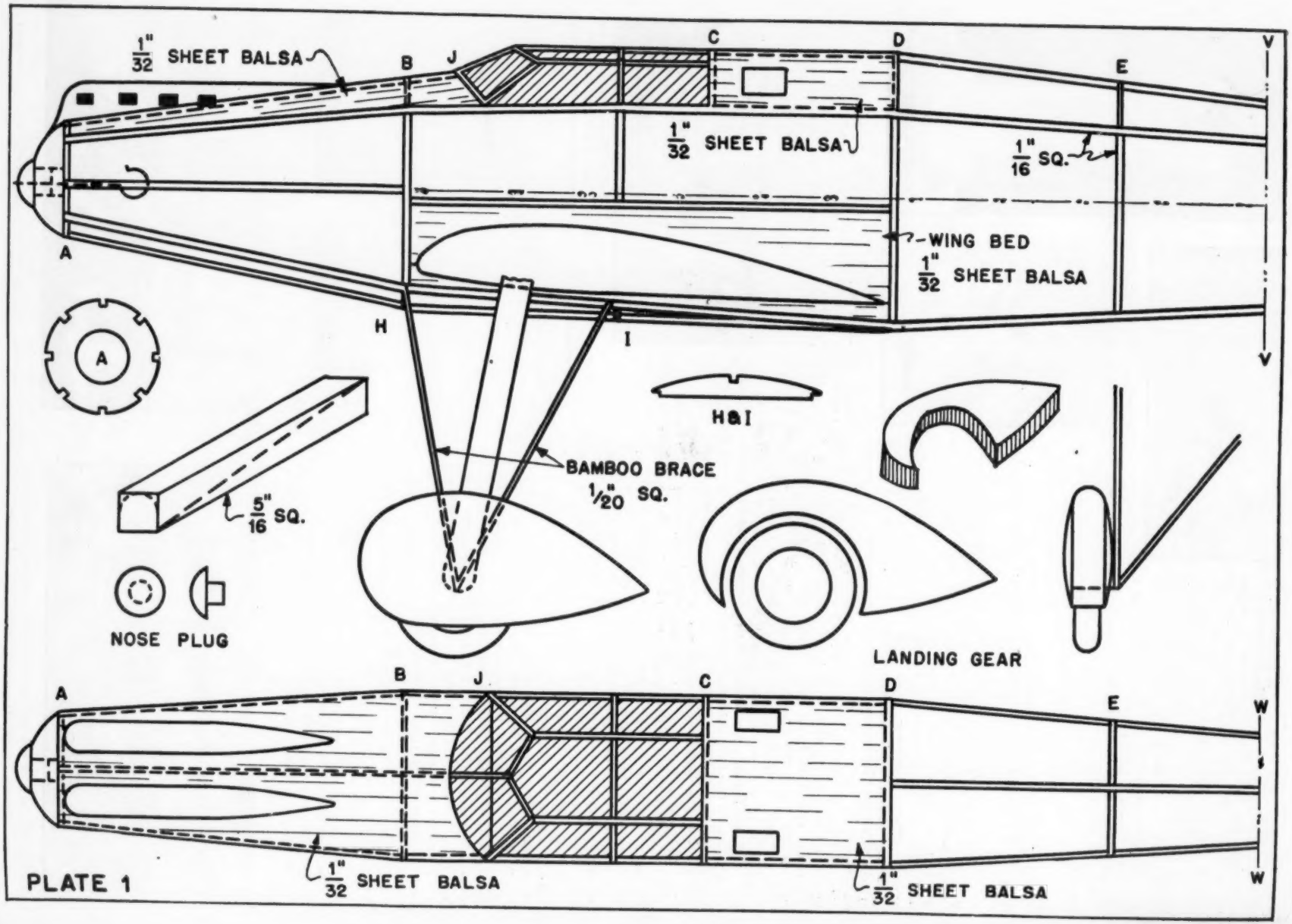
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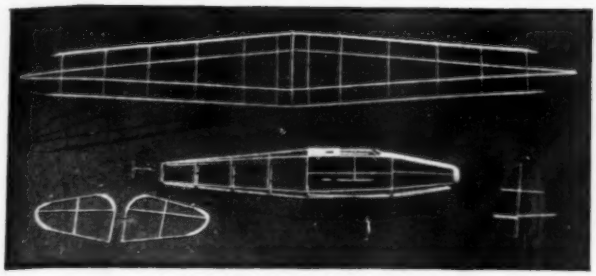
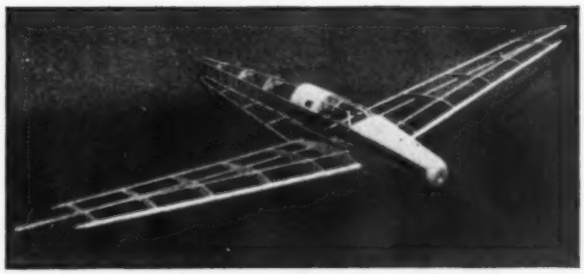
PLATE 1



The frame parts ready to assemble



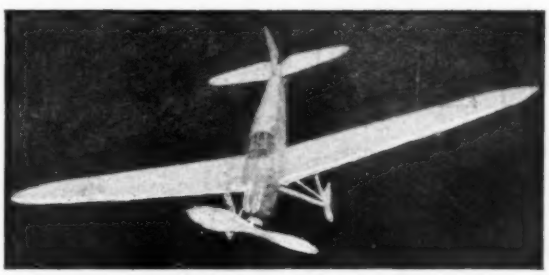
The wing frame in place through the fuselage

Building the Dewoitine D-33

Complete Data From Which You Can Build a Flying Scale Model of a Famous French Plane, with Contest Performance

By STEPHEN FAYNOR

THE Dewoitine D-33 is a high performance duration plane, which was built by the French in 1930. It is powered with a Hispano Suiza 650 h.p. engine. Flown by Marcel Doret and Joseph Le Brix, it established seven world's records in 1931. The model which is described below, lives up to its larger prototype in the respect of unusual performance. It has a wing span of 26 inches and looks, as well as acts, like an outdoor commercial model. Flights of over one minute duration can easily be obtained. Before constructing the model, be sure to look the plans over thoroughly and obtain a clear picture of the details as well as the general construction. This will help you to understand the instructions.



The finished model ready to fly

Fuselage

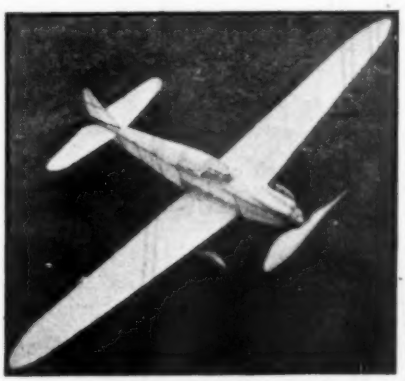
We will start our work by assembling the fuselage. A very good way to start constructing the model is to piece the various pages of drawings together on a soft drawing board. Spread waxpaper on top of the drawings and pin these down also. Now you are ready to begin your work.

Place pieces of 1/16" square medium hard balsa over the main longerons on the drawing. These pieces are held in place with pins. After this is done, put in the upper and lower longerons. These should be 1/16" square and cemented carefully in place. Make both sides of the fuselage in this manner and allow them to dry thoroughly before they are removed from the paper.

When the cement is dry, our task is to place these together properly into the form of the fuselage. This is done by first cementing in formers B, C and D to the top longerons, and H and I to the two lower longerons. Be sure that the formers are perpendicular to the longerons. Next cement in the formers E, F and G in the same manner. They may be held in place with pins. Next the nose former, A, is cemented in place. The four longerons fit into the grooves in the former A. The last former to be put in place is J. This slants forward slightly and acts as the lower base of the windshield.

Now put in place the lower crosspieces at panels D, E, F and G; also put in the short pieces at the extreme rear end of the fuselage. These should be 1/16" square medium hard balsa.

When this is completed you may put in the ridge longerons along the top of the fuselage and fit the pieces together which form the cabin. A stringer also runs from A through H and I to panel D, along the undersurface of the fuselage. The rear end is cemented into the center of the crosspiece at panel D. Now put the cowling of 1/32" sheet balsa over the top of the fuselage at the nose, between panel A and J. A similar piece of 1/32" balsa forms the cabin covering between panel C and D, as shown in the drawing. These pieces should be well sanded. A small piece of balsa is fitted in between the lower longerons at the extreme rear to which the wire holding the tail wheel is cemented. This wire may be 1/32" in diameter. The wheel is cemented to this wire.



A graceful model true to scale

Wing

The wing now may be made. First trace out the ribs on some stiff tracing board. Cut them out carefully and retrace their outline on 1/32" balsa. Then with the point of a broken razor blade, cut out the ribs to conform with the pattern. The trailing edge of the wing is made of 1/16"x⅛" balsa. After this is shaped and pinned to the drawing, the ribs are glued in place.

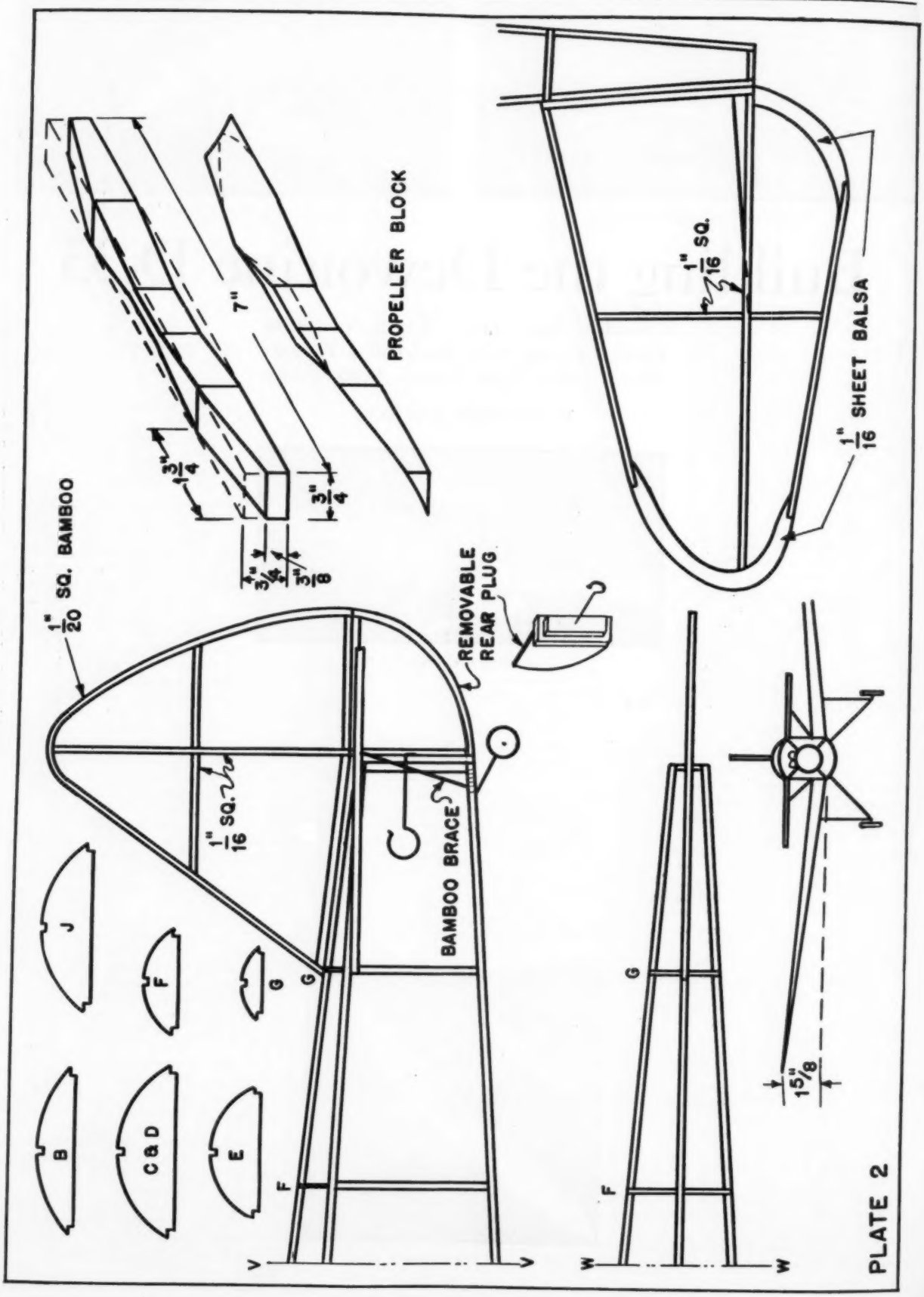
After the cement is dry, glue the leading edge to the ribs. These are shaped from a piece of balsa ⅛" square. These should be tapered to ⅛"x3/32" at one end.

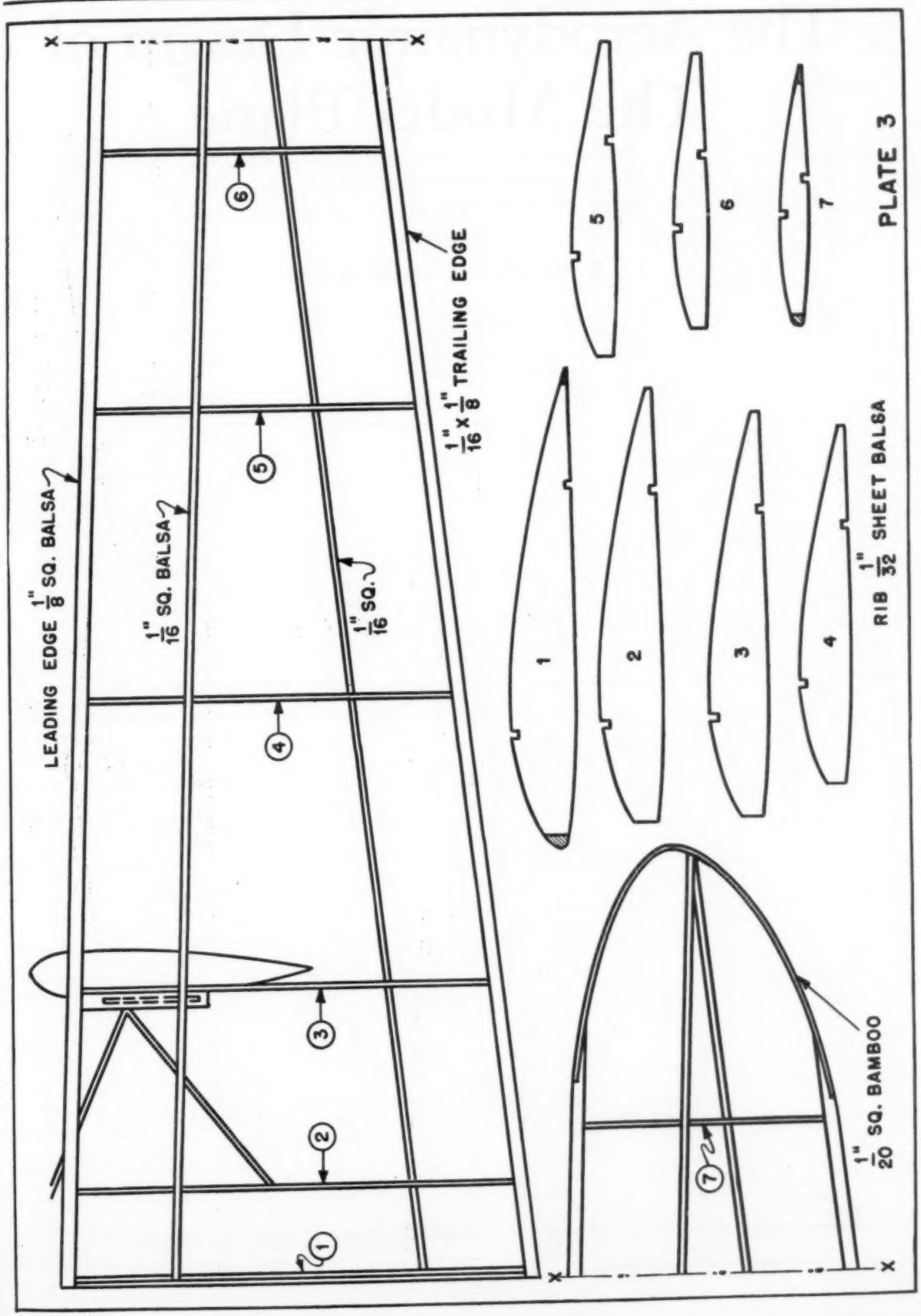
The wing tip may now be formed out of a piece of bamboo and cemented in place to the leading and trailing edges. This is made from a piece of bamboo ¼" wide, which is wet in water and then bent carefully over the heat of a candle to the shape shown in the drawing. When this has been done, strip with the point of a knife so that the bamboo is 1/20" square. It may then be cemented in place.

Now put the upper spar in place. This is 1/16" square and is cemented to each rib. It fits into a groove in each rib, as shown in the drawing. When this is thoroughly dry, the wing may be taken from the board and the lower spar cemented in place in a similar manner to the upper one. This gives you one-half of the wing.

The other half may be made as follows: First trace the plan of the wing on another sheet of paper. Turn the paper over and upon the opposite side trace the wing through the paper. This will give you a reverse of the drawing from which the second half of the wing can be made. When both sides of the wing have been finished cement them together so that *each* wing tip is raised up 1⅝" above the lower edge of the center ribs. If the wings will not fit tightly together when they are dihedraled, fit in carefully small blocks of balsa. A

(*Continued on page* 43)


PROPELLER BLOCK
7"
1 3/4"
3/4"
3/4"
3/8"
1" SQ. BAMBOO
1/20
1" SQ.
1/16
SHEET BALSA
REMOVABLE REAR PLUG
BAMBOO BRACE
J
F
G
B
C & D
E
V
W
15/8"
PLATE 2


LEADING EDGE 1/8" SQ. BALSA
1/16" SQ. BALSA
1/16" SQ.
1/16" X 1/8" TRAILING EDGE
1
2
3
4
5
6
7
RIB 1/32" SHEET BALSA
1/20" SQ. BAMBOO
PLATE 3

The Aerodynamic Design of The Model Plane

Article No. 36

Chapter No. 4

Characteristics of Stretched Lubricated Brown Rubber Motors of Various Strand Sizes of Vital Importance to Model Designers

By CHARLES HAMPSON GRANT

THERE has been considerable speculation among model fliers as to the amount of power gained by lubricating and stretching rubber when winding it, compared to winding it dry without stretching it. Model fliers with only slight experience will concede that there is some advantage to such a practice, but the exact amount has not been known definitely.

In this article we will endeavor to throw some light on the subject by giving you the results of actual tests made on brown rubber of various sizes, lubricated and stretched when wound. The graphs given here show the torque developed at every stage of the unwinding of the motors. On each graph is indicated the size of the rubber and the number of strands used.

In order that the difference in the results obtained from lubricated stretched motors and dry rubber motors may be clearly understood, compare these graphs with the charts shown in the December and January issues, articles No. 34 and No. 35 of this series. In No. 34, graph No. 11 shows the results given by *dry* brown rubber, size ⅛"x1/30". In article No. 35, graph No. 15 shows the results of tests on *lubricated, unstretched* ⅛"x1/30" brown rubber. Now look at graph No. 19 on this page. In the tests, of which this graph shows the results, lubricant was used and the rubber stretched *two and one-half* times its original length when it was wound. The heavy lines indicate the torque delivered by the motors at every stage of unwinding.

The three factors which interest model fliers in regard to rubber motors is the torque delivered at any instant, the maximum number of turns, and the amount of work that can be stored in the motors. Let us compare the torque indicated by the torque curve in graph No. 19 with those shown in graphs No. 11 and No. 15. Considering the ten-strand curves, the obvious fact is that the maximum torque (at the breaking point) is much greater in graph No. 19 than in the other two cases. From graph No. 11, we see that dry brown rubber gave a maximum torque of 10 inch-ounces while the maximum torque obtained from lubricated and stretched brown rubber was almost twice as much; to be exact, 1.9 times as much. Though lubricating the rubber and winding it without stretching gave a slight increase in torque as shown in graph No. 15—from 10 inch-ounces to 12.4 inch-ounces, about 25%—the increase was quite insignificant when compared with the results obtained by stretching the rubber.

We cannot picture the character of a mighty ocean by one lone drop of water, however, so let us consider motors composed of various numbers of strands.

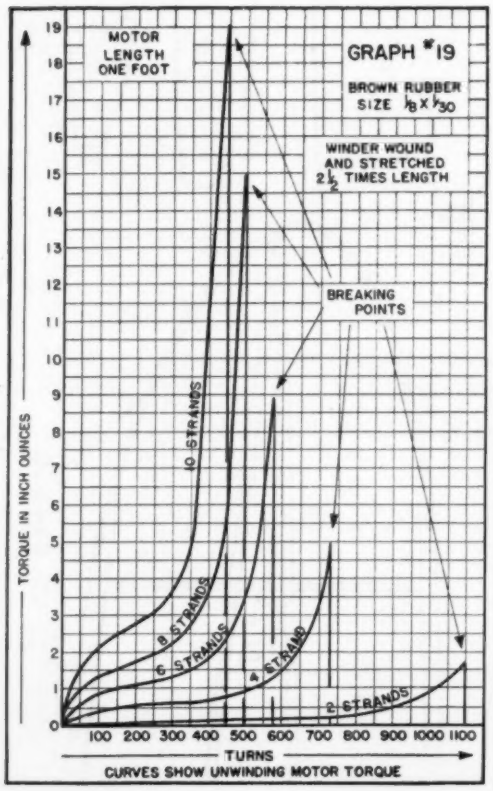
If we compare motors of eight strands, we see that the maximum torque increases from 7.2 inch-ounces in the case of dry brown rubber, to 15 inch-ounces for lubricated and stretched brown rubber. The increase is thus more than 100%. The increase in torque for lubricated rubber not stretched is only about 20% in this case. It is interesting to note from consideration of the graphs, that six, four and two strands show *less increase* in the maximum torque with lubricated and stretched motors. The fewer the number of strands, the less the increase in maximum torque. The advantage becomes less with fewer strands, especially if the rubber is lubricated but *not* stretched. This is evident by a comparison of graphs No. 11 and No. 15. In spite of the high maximum torque delivered by stretched lubricated rubber, as the motor unwinds, this high torque drops quickly to an amount about equal to unstretched lubricated rubber.

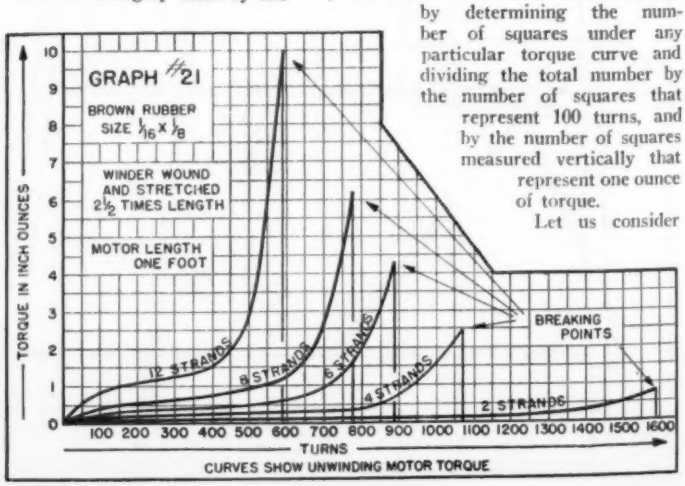
However, the chief advantage of lubricated and stretched rubber lies in the increase in the number of turns that it produces. In every case shown on graph No. 19, it is over 100% and for two-strand motors the *increase* is 140%. From these facts it is evident that lubricating the rubber produces a small increase in the torque and the turns, but stretching lubricated rubber produces a *large* increase in both the torque and the number of turns it is possible to store in the rubber.

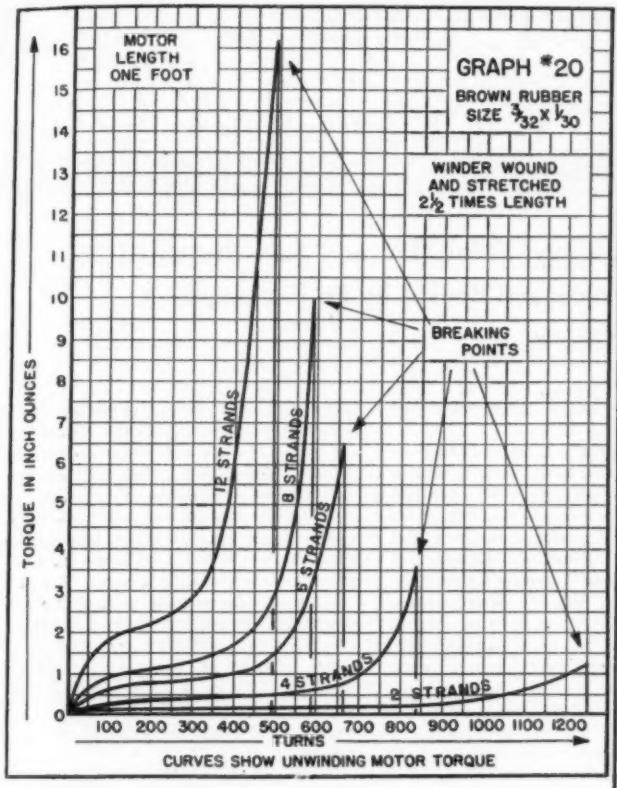
A large increase in the torque and number of stored turns, means a large increase in the amount of work that can be stored in a motor. As this is indicative of the length of time a model will remain in flight under given conditions, it is very important.

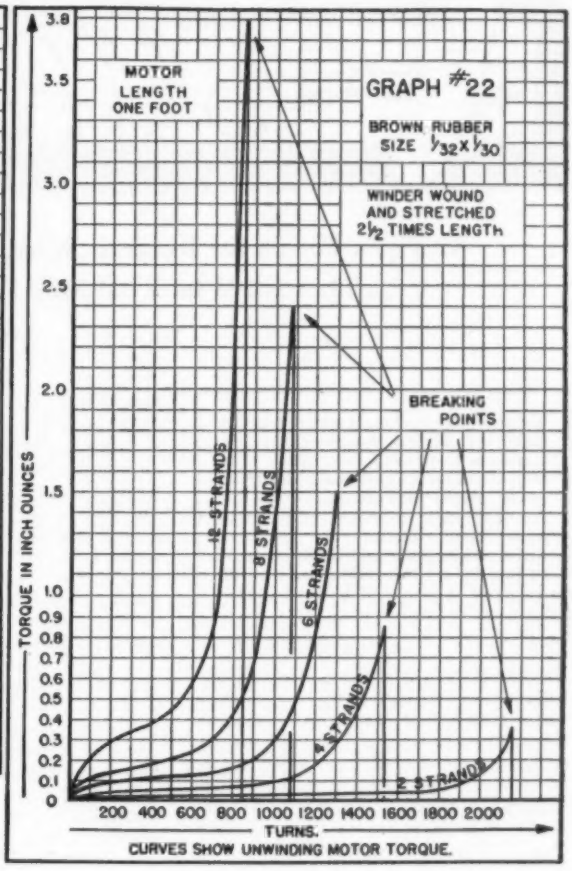
As stated in previous pages of this chapter, the stored work can be calculated by determining the number of squares under any particular torque curve and dividing the total number by the number of squares that represent 100 turns, and by the number of squares measured vertically that represent one ounce of torque.

Let us consider









the amount of work that can be stored in a ten-strand motor, when lubricated and unlubricated. Under the ten-strand motor torque curve in graph No. 11 there are 67 squares. In this graph there are four squares to every 100 turns, so dividing by four we get 16.75. Also there are two squares to every ounce of torque, so we divide 16.75 by two and get 8.375. By the same procedure in the case of *a stretched lubricated* motor of ten strands, we get 20.5. These two quantities, 8.375 and 20.5, are proportional to the amount of work that can be stored in the motors under consideration. So it can be readily seen that stretched lubricated brown rubber motors of ten strands can deliver about 2.4 times as much work as dry *unstretched* brown rubber motors. Let us see if this same proportion holds true for motors of fewer strands.

Upon calculating the work delivered by six-strand motors, we find that the increase in the case of stretched lubricated motors is more than 100%, or the amount of work is about 2.1 times as much as for dry motors. In the case of two-strand motors, about 2.6 times as much work can be stored. Thus we see that regardless of the number of strands in the motor, lubricating and stretching the motor increases the work a motor can deliver, from 110% to 160%.

The advantages may be summarized as follows: (1). The maximum torque is increased from 70% to 100%. (2). The number of turns that can be stored is increased from 100% to 140%. (3). The increase in the amount of work that a motor will deliver is from 100% to 160%.

What conclusions can we make from these facts? Obviously as the duration of a model is approximately proportional to the amount of work delivered by the motor, we know that in any one model the duration is increased from 100% to 160% by lubricating and stretching the motor when winding it up. Also as there is a large increase in the maximum torque by such procedure, it is wise to lubricate and stretch motors when you desire a steep and fast initial rate of climb or where great power is desired at the start of a flight as in the case of R.O.G. or R.O.W. "take offs."

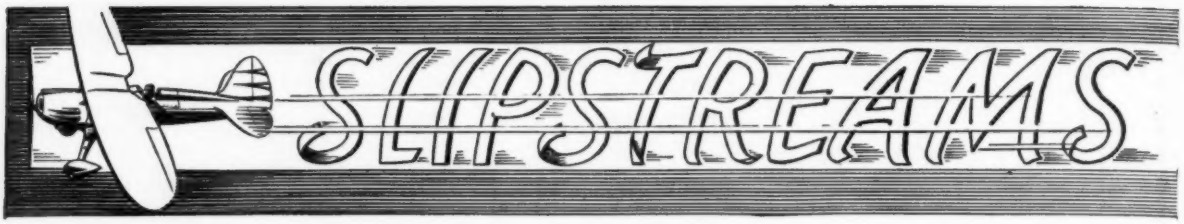
The graphs on these pages show results of tests made with *various sizes* of strands. Examination of them shows that the maximum torque increases greatly with an increase in the size of the strands used, provided the motor contains the same number of strands. The increase in the maximum torque is practically proportional to the size of the strands used, in every case. In fact, the increase is a little more than directly proportional to the strand size. For instance, the maximum torque for an eight-strand motor of ⅛"x1/30" rubber is 15 inch-ounces, which is a little more than twice the maximum torque of 6.26 inch-ounces for an eight-strand motor of 1.16" x1/30", half the size of ⅛"x1/30" rubber.

The number of turns it is possible to store in a motor decreases with the size of the strands, but not in direct proportion to the strand size. The number of turns is approximately inversely proportional to the square root of the size of the strands, or $\sqrt{S}$, where (S) equals the size of the strands used (cross section area). This means that if the size of the strands of a motor is doubled, you will be able to put only 75% as many turns in the motor, provided the same number of strands is used.

The amount of work delivered by a motor is about proportional to the square root of the size of the strands. That is, if the size is doubled, the amount of work is increased about 50% or to one and one-half times as much as in the case of the smaller strands. This is interesting because of the fact that the duration is about proportional to the amount of work that the motor will deliver, provided the power is applied properly through the use of a suitably designed propeller, for each case. The propeller should be designed to turn at the same rate of speed in both cases. The advantage comes in the greater altitude attained by the model with the *larger* but *same number* of strands.

Many builders have always wished to know how the power of a motor varies with the increase in the number of strands in the motor, *the size of the strands being the same.* Each individual graph shows the relationship of motors composed of various numbers of strands in regard to torque, turns, and work. There is a decided increase in the torque at any number of turns on a rubber motor as shown by the torque lines on the graphs. This fact is as one would expect it to be. However, some builders have been under the illusion that the torque increases in proportion to the number of strands in the

(Continued on page 40)



An Open Forum for Readers, What They Think, Do and Say, Presented So That All Who Read May Enjoy and Benefit by an Exchange of Ideas

We cordially invite all our readers to make use of this department of the magazine to present their ideas, criticisms, arguments and commendations, on *all* phases of aviation. If you feel that any idea presented herein warrants commendation or criticism, write, telling what *you* think about it, so that by debate, "truth" may be determined. Address all letters to "SLIPSTREAMS."—*The Editor.*

IN SEVERAL of our past issues we published ideas submitted by our readers, which have caused considerable comment. One of the letters from Joseph F. Morris, advocated the use of hard wood in the construction of model airplanes rather than the use of balsa. It appears that other readers take exception to this procedure. One of those who feel that some word regarding this matter is necessary, is Mr. C. L. Bristol, an old contributor to *Universal Model Airplane News*. Let us hear what he has to say:

Balsa vs. Hardwood

"My first model planes were built of pine splinters, bamboo and fish glue, the only materials available to me in those ancient days. Loudly I hailed the advent of balsa, ambroid and the various acetoid nitrate products as being a stride forward, a boon to model aviation. These things have converted what was once a difficult and unpopular hobby into a scientific pastime, world-wide in scope. Comes now a gentleman who is Mr. Joseph F. Morris and says, 'Go Back!'

"This is not the first time that modern models have been scornfully branded as floaters. Yet it is by far the most graphic presentation of the idea to be seen. Does Mr. Morris know that aircraft designers are not trying to make their planes as heavy as possible? Instead, they seek to build them as light as the requirements of strength and safety will allow. Balsa members in model planes up to three or four feet in span, assures the builder of greater strength proportionately, than is found in the prototype. Again, balsa built flying models will land with sufficient grace and ease that they may some day fly another time. I invite Mr. Morris to build a model correctly scaled as to wing loading and make it fly. This would mean of course, that his model of one square foot in wing area would weigh in the neighborhood of twelve pounds!

"I am in perfect accord with Mr. Morris' theory that one must have a strong sense of accomplishment to compensate for the lack of performance resulting from a poor selection of material in the model plane. Pride of workmanship is a splendid quality, but pride of judgment should be equally important. We can find a place for every material available to model airplane construction, balsa and spruce alike. Let us therefore temporize and proceed in a manner that is consistent with modern progress. While our Mr. Morris hones his chisel and files his saw, let us pursue our study of aerodynamics with model planes that perform efficiently.

"I firmly believe that the tiny craft possessed of enough soaring qualities to seemingly float away in a breeze, should give its builder a far greater sense of accomplishment than the knowledge that he, and Daniel Boone, has made a tough bit of hickory 'Do his bidding.' Weight rule has long since been recognized as a means of speeding the contest and developing maximum efficiency in the model. However, its present form is several times milder than Mr. Morris suggests.

"I have only the greatest admiration for the 'Bumble-fingered ten year old' so colorfully painted by this gentleman. At twenty, those Bumble-Fingers will surely be a skillful credit to their owners, and to the nation.

"I do not mean to appear in any way scornful of fine craftsmen in any field. But too long have we ignored the yammerings of this particular group, who seek to subordinate aviation to their own obsolete sideline."

In our November issue Bud Smith contributed his idea of the speed plane of the future, telling of its features and how he thought they would be superior.

James Holder seems to have some criticism concerning Bud Smith's idea. We will let you judge for yourself who is right in this matter. What Mr. Holder has to say follows:

Power Driven Wheels

"If I may (without hurting anyone's feelings), I would like to say that Bud Smith is very imaginative but also very impractical. His design is unusual but 'all wet.' First, the long nose will detract from the perfect streamline which is blunt in front, thus adding wind resistance and slowing down the plane.

"Second, the conical gears are easy to describe but hard to make, thus very expensive. Gears of any kind reduce efficiency to an amazing degee.

"Third, the present motors can swing props too fast for efficiency. The most efficient is a large, high pitch, slow moving prop. For speed, the best is a medium sized, medium pitch. The speed of a plane is largely determined by the choice of a prop rather than the speed at which it is turned.

"Fourth, the prop is at such a distance from the center of gravity that it would act as a gyroscope, adding to the difficulty of maneuvering the plane.

"Now having disagreed, I would like to partially agree. His idea of a vertical fin at the tip of each wing is good, but would be better if the fins slanted outward instead of being attached to the wing in a vertical position."

Beside comments on ideas which have been presented in previous issues, we have some new features in which you may be interested.

Rade Lambert has been experimenting with power-driven wheels by means of which he has hoped to increase the speed of the take-off of his model planes.

Future Speed Plane Criticised

Figure No. 1 shows a diagram of his apparatus. Before the model is released, the wheels are wound up with equal ten-

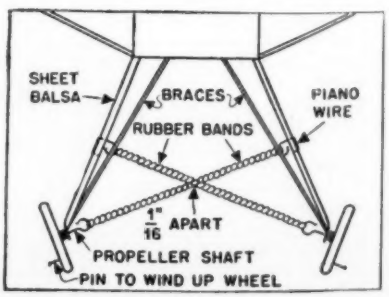


Fig. No. 1

sion on the two rubber bands. The machine is then set on the ground in preparation for a take-off. Upon being released, the rubber bands are supposed to drive the wheels and accelerate the plane quickly into flight.

Have any model builders tried this one? What do you think about it?

Harold Phillips contributes an idea which he feels may be of value to model builders. He has tried it successfully on his own models. It is shown in Figure 2. He says:

"This gadget of my own thinking can be made to perform several automatic functions, such as making an elevator raise as the rubber power dies out, thus increasing a plane's glide, dropping bombs automatically all at once or one at a time, or dropping parachutes the same way. It is light and easy to make and can be made to fit on any plane.

"It is made by first having a shaft model of wire connected to the rubber in the rear of the plane the usual way, passed through a firm plug to a second plug which the shaft is connected to. Before connecting the shaft to the second plug, insert a coiled spring or a springy piece of metal, pierced at both ends and slip over shaft. If this was a plain pull and push on the shaft, this would be enough, but we have a pull and twist at the same time and the rubber winds would spin out at the rear of the rubber instead of the front, so to counteract that, we insert two other shafts fixed in the firm plug. However, allow the second plug to move freely up and down, the shafts prevent it from turning, as you can readily see.

"In number one we see the second plug open or away from the fixed plug. There is no tension on the shaft so the spring shoves the second plug out. When the motor is wound up, the tension of the rubber pulls the plug and spring in, but as the motor unwinds its tension decreases and the springs start moving outward. That is where the movement is utilized. A thread attached to the second plug may go to a trap door in the bottom of a plane and pull out the door, dropping bombs or parachutes. It can be used to raise the elevators also. This is especially beneficial in the type of plane that flies well but has a steep glide."

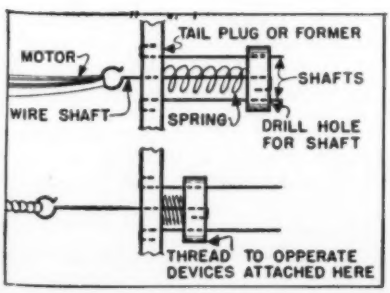


Fig. No. 2

Probably a number of our readers may find use for this device, as Mr. Phillips suggests. What do you think about it?

Model builders often take pleasure in having their models execute maneuvers similar to large ships. One of them is dropping bombs while in flight. Mr. E. Revel Conover, Jr., presents here a plan for a bomb which may be carried on the model. He has found it very successful in operation. It is shown in Figure No. 3.

A very unique device has been suggested by Kenneth Steen. The purpose of it is to increase accuracy in taking pictures. Scales showing details of this device are shown in Figure No. 4. Mr. Steen says:

"I got this idea from the gun used by the Navy, although the resemblance is not too great. It is very simple, requiring very little material.

"To begin with, take a length of stock about two and one-half feet long. It must be wide enough to mount a camera so that it will face in line with the barrel (the wider the barrel the more accurate the alignment). A good dimension is one inch

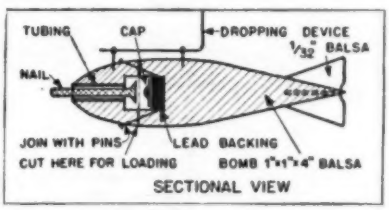


Fig. No. 3

by one-and one-half inches. Splice a bee-bee gunstock with the barrel as shown in the drawing.

"Next procure a box camera. Mount it on the underside of the barrel, with the lever in the upper left-hand corner. The camera should be no more than three inches from the end of the gun. This is to prevent taking a picture of the end of the gun.

"Attach a wire hook on the lever; from this run a string directly up through a screw-eye on the barrel, then back to another screw-eye about a foot from the end. Then attach a trigger a few inches in back of this. To snap the lever back, place the end of the finger over the shutter, to keep the light out, and snap deftly with the other hand. The camera may be made detachable by the following method:

"Drive the headless nails into the barrel as shown, leaving a space large enough to hold the camera. Drive in two more nails. Bend the two pair slightly toward each other. Be sure the camera has the correct alignment. This is very important.

"Next comes the sights. These are rigged up by shaping a piece of wire, as illustrated for the rear sight and a blackhead pin for the front. Make sure that these also are in correct alignment.

"This idea has helped me a great deal in photographing models in flight. It also

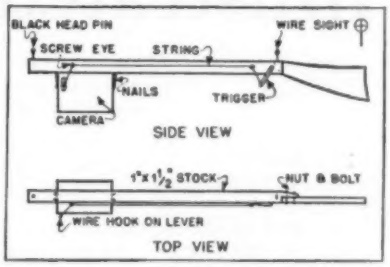


Fig. No. 4

adds a lot of fun to taking the pictures and I hope you will be able to use it."

Now, most of our photography hounds can be certain that they are speaking the truth when they remark that they intend to "shoot" a picture. What do you think of this idea?

A very interesting letter comes from Manuel Rodriguez of Cuba, telling us why he likes to build model planes and the types he prefers to build. It will help to give some of our model fans an idea of the extensive amount of information it is possible to acquire from model building and the excellent preparation that may be had for various activities later in life if a little thought is used in connection with your activities in model aeronautics. He writes us as follows:

Why I Like to Build Model Planes

"The building of model planes is the best way to acquire a thorough knowledge of the science of aeronautics. It provides a means of testing, *in actual flying conditions,* any improvement or any novel idea which we may desire to incorporate in a flying machine. It is the least expensive method of experimenting; the only one which has made possible a wonderful reality—such as the Autogiro. In fact, it was the observation of the steady flight of one of those models, which led the inventor to the discovery of the idea of the non-rigid attachments of the rotative vanes, which made possible the successful flying of full size machines.

"Now, it has been applied to the study of the tailless planes, and it has been considered by German scientists, as in the case of Juan de la Cierva. Only in this way they can carry on all the experiments, otherwise too difficult and expensive. (See No.564 Report of the N.A.C.A. of Washington).

"Another valuable contribution to the science of aeronautics is the building to exact scale, solid wind tunnel models of full size machines to be constructed. In this way, characteristics may be determined before actual construction takes place.

"Aside from these fields of usefulness that make model planes valuable, is the sportive one. Ask any model builder if there is any feeling of happiness greater than that of watching a laboriously made

(Continued on page 36)

Illustrated Aviation Dictionary

Many model builders and other readers are often in doubt with regard to the meaning of common aeronautical words. A number of them will be defined each month, therefore, in order to give readers a larger scope of understanding

By EDWIN T. HAMILTON

153. **HANGAR.** A building, shed, tent or any other form of housing used to shelter aircraft.

154. **HELICOPTER.** See *Autogiro.*

155. **HORIZONTAL TAIL FIN.** Same as *stabilizer.*

156. **HORN.** A small, short lever extending out from a control surface of an airplane, to which is attached the control wires of that surface.

157. **HORSE - POWER OF AN ENGINE, MAXIMUM.** The greatest amount of power which any engine is able to develop.

158. **HORSE - POWER OF AN ENGINE, RATED.** The average horsepower an engine develops in passing the standard fifty-hour endurance test.

159. **HULL, SEAPLANE.** The portion of a seaplane which furnishes buoyancy when on the surface of the water. It also accommodates the pilot and passengers, controls, instruments, etc. Usually incorporates the functions of a float and fuselage in one unit.

160. **HYDROPLANE.** Erroneously used to denote a seaplane. A hydroplane is a type of boat, designed for great speed, but not built to leave the water.

161. **IMPACT PRESSURE.** The quantity measured by most instruments which are used to express or measure, air speed.

162. **INCLINOMETER.** An instrument which indicates the angle of an aircraft in flight, along its lateral or longitudinal axes, with relation to the horizontal.

163. **INDICATOR, AIR-SPEED.** See *air speed indicator.*

164. **INDICATOR, DRIFT.** Same as *drift meter.*

165. **INDICATOR, FLIGHT.** An instrument in which a lateral inclinometer, a fore-and-aft inclinometer, and a turn indicator are combined to form a compact unit.

166. **INDICATOR, GYROSCOPIC TURN.** A turn indicator dependent on gyroscopic action.

167. **INDRAFT.** The flow of air which strikes the propeller blades from in front of them.

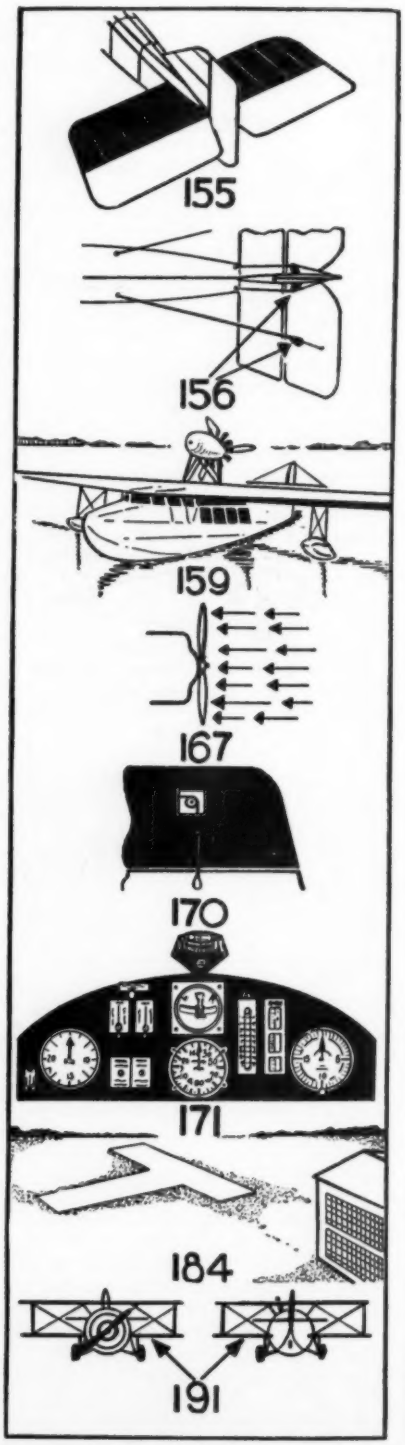
168. **INDUCED DRAG.** See *drag, induced.*

169. **INFLOW.** Same as *indraft.*

170. **INSPECTION WINDOW.** A small, transparent window or opening, in the wings of an airplane to allow inspection of interiors.

171. **INSTRUMENT BOARD.** The panel in the pilot's cockpit on which the instruments are mounted.

172. **INVERTED ENGINE.** See *engine, inverted.*



173. **JOY-STICK.** Nickname for control-stick. This is a deviation from the word Joyce stick. See *control stick.*

174. **JOYCE STICK.** Same as *control stick.* Named after its inventor, Joyce, a British officer.

175. **KING POST.** A main compression member, usually vertical, designed to support a single or triangular member subject to bending.

176. **KYMOGRAPH.** An instrument for recording the angular oscillations of an aircraft in flight with respect to axes fixed in space. The reference direction is usually given by a gyroscope or a beam of sunlight.

177. **LANDING.** To propel aircraft from the air to earth. The act of making a landing.

178. **LANDING ANGLE.** Same as *ground angle.* See *angle, ground.*

179. **LANDING FIELD.** Any field, whether a complete airport or not, which is suitable for the landing and taking off of aircraft. See *airport* and *airdrome.*

180. **LANDING FIELD, EMERGENCY.** A locality, either of water or land, which is adapted for the landing and taking off of aircraft, but which is not equipped with facilities for the shelter, supply and repairs of aircraft and is not used regularly for the receipt or discharge of passengers or cargo.

181. **LANDING GEAR.** The understructure which supports aircraft when in contact with land or water. Also called *undercarriage.*

182. **LANDING GEAR, BOAT TYPE.** Same as hull type landing gear. See *hull, seaplane.*

183. **LANDING SPEED.** The minimum speed at which an aircraft can maintain itself in level flight and still be under adequate control.

184. **LANDING "T".** A large symbol shaped like a capital T which is laid out on a landing field or the top of a building to guide pilots of aircraft in landing.

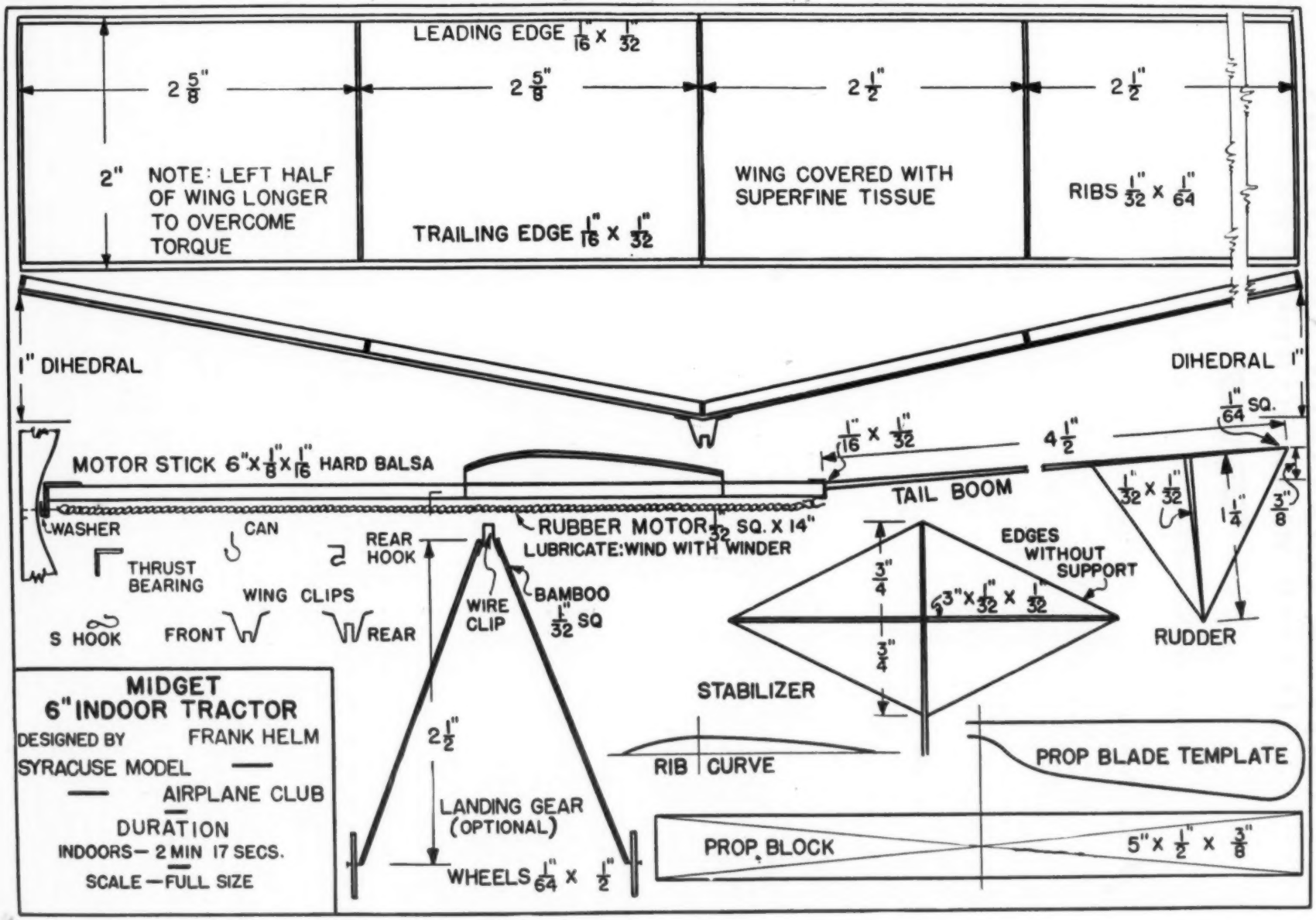
185. **LANDING WIRE.** A wire designed to oppose the lift wire and prevent distortion of the structure to which both are attached. Usually refers to the wires on the main supporting surfaces or wings, of a biplane or multiplane.

186. **LANDPLANE.** An airplane designed to land and take off from land.

187. **LATERAL AXIS.** The axis which extends from wing-tip to wing-tip of an airplane, at right angles to the longitudinal and lateral axes, both of which pass through its center.

188. **LEADING EDGE.** The edge that leads. The foremost or front edge of a wing or propeller.

189. **LEEWAY.** Same as *drift.* See *drift.*


LEADING EDGE 1/16" X 1/32"
2 5/8"
2 5/8"
2 1/2"
2 1/2"
2" NOTE: LEFT HALF OF WING LONGER TO OVERCOME TORQUE
TRAILING EDGE 1/16" X 1/32"
WING COVERED WITH SUPERFINE TISSUE
RIBS 1/32" X 1/64"
1" DIHEDRAL
DIHEDRAL 1"
MOTOR STICK 6"X1/8"X1/16" HARD BALSA
1/16" X 1/32"
4 1/2"
1/64" SQ.
TAIL BOOM
1/32" X 1/32"
1 1/4"
3/8"
WASHER
CAN
REAR HOOK
RUBBER MOTOR 1/32 SQ. X 14"
LUBRICATE: WIND WITH WINDER
THRUST BEARING
WING CLIPS
S HOOK
FRONT
REAR
WIRE CLIP
BAMBOO 1/32" SQ
3/4"
3"X1/32"X1/32"
EDGES WITHOUT SUPPORT
3/4"
RUDDER
STABILIZER
RIB CURVE
PROP BLADE TEMPLATE
2 1/2"
LANDING GEAR (OPTIONAL)
WHEELS 1/64" X 1/2"
PROP BLOCK
5"X 1/2" X 3/8"
MIDGET
6" INDOOR TRACTOR
DESIGNED BY FRANK HELM
SYRACUSE MODEL — AIRPLANE CLUB
DURATION
INDOORS— 2 MIN 17 SECS.
SCALE—FULL SIZE

NATIONAL AERONAUTIC ASSOCIATION
JUNIOR MEMBERSHIP NEWS

Prepared by National Aeronautic Association, Washington, D. C.

News From the Chapters

COLUMBUS, Ohio, is experiencing an increased activity among its N.A.A. junior members under the energetic leadership of C. Nelson Black, newly appointed N.A.A. Contest Director. Mr. Black has been actively interested in aeronautics and model plane matters for a number of years and has an impressive record of accomplishment in his own contest participation, particularly at national meets.

The Columbus model builders and flyers are intent on getting some more of their names on the list of record holders. One of their members, Bob File, has already established an outstanding record in the outdoor glider event. His flight of 23 minutes 13 seconds, made at Akron last June, still stands as the official record.

Mr. Black reports that he has the hearty support of the newspapers, the Union Company, the American Legion and other organizations in his efforts to secure sponsorship for Columbus model plane meets. With one of his experience and initiative at the head of the Columbus chapter, it is certain that the club will make a great success of its activities. All those in the Columbus area who are interested, should contact Mr. Black at 1085 Fair Avenue or at the Union Company's Scout Shack.

BOSTON has one of the most active chapters in the N.A.A. organization. The N.A.A. chapter there is the Jordan Marsh-Boston Traveler Junior Aviation League. A more intelligent and constructive leadership would be hard to find than that of Captain Willis C. Brown, club director and member of the Association's Committee on model planes.

The club holds weekly meetings and has enjoyed hearing many of the great leaders in aviation. Among the guest speakers during the past few months are Lieutenant Harry Copland who has been delivering military planes to South American countries; Lieut. Col. Louis E. Boutwell, Massachusetts National Guard; Captain Glenn Salisbury, U.S. Army Air Corps; Mr. George Mason, Massachusetts Governor of the N.A.A.; Mrs. Heraclio Alfaro, famous autogiro designer; and others.

The club's weekly newspaper, Wing Overs, is edited by Albert Lewis who is also the club's president. This weekly is a huge credit to its editor and to the Boston chapter. Many items of news and technical interest are regularly published.

One of the club's experts, Bruno Marchi, is conducting a beginners' class in which the essentials of correct construction are demonstrated. The class learns by doing and it is open to all members who wish to avail themselves of the opportunity.

The Boston boys have several perpetual trophies which have been established for competition at regular Boston meets. One of these is the Lieutenant Henry B. Harris Memorial Trophy in memory of the former flyer and glider expert. Another is the 101st Observation Squadron Trophy. These trophies are now held by Torrey Capo who will hold them until some club member betters his flight times. Thus, the holder will always be the Boston record holder. This plan is an excellent one for other chapters to follow. It stimulates lots of interest.

SPRINGFIELD, Massachusetts, N.A.A. junior chapter has captured another flight record. Michael Barco, on November 10, at a sanctioned meet outdoors, flew his Class D stick model for a new open class record of 1 minute 52.4 second.

Mr. Ernest A. Walen, club director, promises that Springfield will have a good sized delegation at the Eastern States Indoor meet in New York, December 28. This very active club doesn't miss a chance to take part in a model contest.

Incidentally, Mr. Walen possibly knows as many individual junior members of the N.A.A. as anyone. He is literally a traveling delegate as his business keeps him on the road much of the time and he is always looking up model plane enthusiasts. He has been conducting some careful experiments on propellers and rubber motors with his testing machine and promises to have some extensive data ready for publication in these columns next month. He has actually demonstrated that a propeller can be so built that it will deliver more pitch distance than its geometric pitch and will explain how this is accomplished. Look for his article next month in this department.

AKRON, Ohio, N.A.A. junior chapter is now known as "The Edith Van Orman Junior Chapter." This name change was made in honor of the late Mrs. Van Orman, the first member of the Akron Women's Chapter to suggest that Akron have a junior group. Mrs. Van Orman was the wife of Lieutenant Ward T. Van Orman, famous aviation authority, whose duties centered his work in Akron.

The Akron group is growing steadily and interest there is as great as ever. Several meets have been held in Akron and the members are making preparations for a full Winter and Spring program of club activities.

PHILADELPHIA Model Aeroplane Association, N.A.A. Junior Chapter, has been very active during the past fall and early winter. Every two weeks, an officially sanctioned meet is conducted. The last outdoor meet was held on November 3 during rather windy weather which prevented any record flights. The winners at this meet were William Sharp, Richard Grannis, John Becht, Richard Siegel, Hyman Oslick and Charles Heintz.

Mr. Victor R. Fritz, P.M.A.A. Field Director, reports plenty of active interest among N.A.A. junior members in Philadelphia.

General News

THE Contest Committee of the N.A.A. held a most interesting regular monthly meeting at headquarters in Washington on November 28. Mr. Elliott Roosevelt, the President's son, is acting as assistant to the Association's President, Senator McAdoo, during his absence in the Philippines, and was present at the meeting.

The records of accomplishment of the Association's junior members were reviewed and all in attendance at the meeting were enthusiastic about the fine showing that has been made during the past year. The number of official model flights of over twenty minutes was pointed out and the committee expressed the belief that American model flyers will continue to lead the way for the flyers of all nations.

General plans for the next year's junior membership program were discussed and the question of the location of the 1935 National Championship Model Plane Meet was brought up. Several localities have made bids for the meet and the final decision will undoubtedly be made at the December meeting.

THE Society of Model Aeronautical Engineers, governing model Aeronautics in Great Britain, has announced its intention to enter a team of six in the 1935 Moffett Contest, which is a part of our National Championship Meet. The United States has been invited to reciprocate by entering the same sized team in the Wakefield Competition that is to be held in England during the early part of next summer. No definite dates have been set as yet for these

British Friends—Mr. B. K. Johnson, Secretary of S.M.A.E., Mrs. Johnson and J. E. Pelly-Fry, Famed Model Expert.

events which are the outstanding international model airplane contests.

It is hoped that next month full information will be available so that it may be published here. These international events do much to promote good feeling between the various participating countries and help to keep them all informed of the trend in model aeronautics.

Technical Discussion

THE following article was written for WING-OVERS by J. P. Glass. It has been favorably commented upon by such a number of experts that it is believed well worth repeating for the benefit of all model enthusiasts.

"HOW TO ADJUST INDOOR MODELS"

1. Check by looking down the motor stick.
   (a) Stabilizer should be at slightly less

(Continued on page 30)

NATIONAL AERONAUTIC ASSOCIATION OF U.S.A.
DUPONT CIRCLE
WASHINGTON, D.C.

I hereby make application for membership in the National Aeronautic Association as a Junior Member. I am under twenty-one years of age.
I enclose fifty cents for initiation fee and first annual dues (Use check or money order.)

Name .....
(Please print or type)
Street .....
City ..... State .....
Date of Birth .....
(Month, Day, Year)
Approved .....
(Parent sign here, if applicant is under eighteen)

OFFICIAL MODEL AIRPLANE RECORDS

Approved by Contest Committee of the N.A.A.
Through November 10, 1934

INDOORS

STICK MODEL AIRPLANES, Hand-launched

CLASS B

Junior: John Whitehouse	Springfield, Mass.,	13m 04s
Senior: Ralph Kummer	St. Louis, Missouri	17m 49.8s
Open: Michael Lichstein	Philadelphia, Pa.	14m 45.8s

CLASS C

Junior: John Stokes	Huntingdon Valley, Pa.	18m 53.4s
Senior: "Pete" Andrews	Philadelphia, Pa.	20m 22.8s
Open: Carl Goldberg	Madison, Wisconsin	22m 59.4s

STICK MODEL AIRPLANES, R.O.G.

CLASS A

Junior: Joseph Pruss	Philadelphia, Pa.	10m 25s
Senior: Merrell Malley	Atlantic City, N. J.	10m 56.4s
Open: Michael Lichstein	Philadelphia, Pa.	8m 40s

CLASS B

Junior: Louis Shumsky	Atlantic City, New Jersey	9m 15.2s
Senior: William Latour	Philadelphia, Pa.	14m 40.2s
Open: Michael Lichstein	Philadelphia, Pa.	11m 06s

STICK MODEL AIRPLANES, R.O.W.

CLASS A

Junior: James Shivler	Philadelphia, Pa.	3m 41.8s
Senior: Paul Karnow	Philadelphia, Pa.	5m 01.4s

CLASS B

Junior: James Mooney	Philadelphia, Pa.	8m 37.6s
Senior: Mayhew Webster	Philadelphia, Pa.	11m 55s

GLIDERS, Hand-launched

CLASS A

Junior: Hewitt Phillips	Belmont, Mass.	21.6s
Senior: David B. Hecht	New York City	34.4s

CLASS B

Junior: Paul Durup	Boston, Mass.	16s
Senior: David B. Hecht	New York City	31.6s

CLASS C

Junior: Stanley Congdon	Glen Ridge, New Jersey	17s

AUTOGIROS

Junior: Raymond Steinbacher	Ridgefield, N. J.	57.2s
Senior: Alton H. DuFlon, Jr.	Ridgefield, N. J.	2m 01.2s

FUSELAGE MODELS, R.O.G.

CLASS B

Junior: Theodore Golomb	Philadelphia, Pa.	6m 26s
Senior: Herbert Greenberg	Newark, New Jersey	12m 23.5s
Open: Jesse Bieberman	Philadelphia, Pa.	2m 55s

CLASS C

Junior: Hyman Oslick	Philadelphia, Pa.	12m 59.4s
Senior: Emmanuel Enderlein	Philadelphia, Pa.	13m 24s
Open: Jesse Bieberman	Philadelphia, Pa.	6m 31.2s

FUSELAGE MODELS, R.O.W.

CLASS B

Junior: John Stokes	Huntingdon Valley, Pa.	3m 23s
Senior: Bruno Marchi	Boston, Mass.	3m 11s

OUTDOORS

STICK MODEL AIRPLANES, Hand-launched

CLASS C

Junior: Bruno D'Angelo	Philadelphia, Pa.	8m 29.4s
Senior: Vernon Boehle	Indianapolis, Ind.	15m 00s
Open: Bernard Collins	Providence, R. I.	3m 23s

CLASS D

Junior: Fred Skafec	Akron, Ohio	8m 21.6s
Senior: Ralph Kummer	St. Louis, Missouri	20m 54s
Open: Michael Marco	Springfield, Mass.	1m 52s

GLIDERS, Tow-launched

CLASS C

Senior: Bob File	Columbus, Ohio	23m 13s

CLASS D

Junior: Stanley Congdon	Glen Ridge, New Jersey	45.2s
Senior: Fred Korn	New York City	1m 16.2s

AUTOGIROS

Senior: Ralph Kummer	St. Louis, Missouri	2m 06s

FUSELAGE MODELS, R.O.G.

CLASS C

Junior: Donald Mertens	Erie, Pennsylvania	1m 44s
Senior: Russell Yungbluth	St. Louis, Missouri	11m 35s
Open: Bernard Collins	Providence, R. I.	2m 56s

CLASS D

Senior: Vernon Boehle	Indianapolis, Ind.	8m 43s
Open: Michael Lichstein	Philadelphia, Pa.	1m 28s

CLASS E (Gasoline Engine)

Senior: Maxwell Bassett	Philadelphia, Pa.	21m 57s
Open: Carl V. Carlson	Chicago, Illinois	6m 48.5s

angle of incidence than wing, and should not be warped.

(b) Wing spars should be straight and wing should be at same angle of incidence from tip to tip, or slightly washed in at left tip (right tip facing model). On no account is any part of the wing to be at less incidence than the center. There should actually be about 1/8 inch more dihedral in the front than in the rear spar of the wing. Use straight dihedral or very little wing turnup.

2. Wind motor 1/3 capacity and try a flight.

(a) If prop kicks, check to see that it is not caused by rubber being knotted on shaft and see that shaft is perpendicular to prop. If prop merely does not run true, it does not matter, but if the tail of the model kicks, it is due to one blade having more incidence than the other. Bend shaft so as to increase the incidence of the other blade until kick is eliminated.

(b) Wind 1/3 and try for stalling. Keep moving wing forward till model stalls; mark stick at both wing clips and move back until stall has disappeared.

(c) Circle with the torque, i.e. from right to left or counter clockwise. The model will do this naturally if permitted. If it does not circle sharply enough, give the rudder more left angle. If it remains stubborn, it is due to one wing tip having excessive drag, or the prop is pulling out of line. Check these points; if nothing seems wrong and model still circles against torque, let it do so. Twisting the thrust bearing will help the prop pull the model in a circle. Most models will fly equally well with or against the torque.

(d) The model should fly level and without side slipping.

1. If it does not fly level, correct by changing the washin by bending the wing clips with pliers. Never breathe on the spars as this is not a permanent cure, not to mention that it greatly weakens the spars.

2. If it flies level but goes crabwise or side slips, it is caused by two forces working against each other. Usually it is the prop pulling the model against the circle; in this case twist the thrust bearing. Or it may be that one tip has excessive drag. Try to correct that tip but if this seems impossible, increase the drag on the other tip.

Wiley Post, Stratosphere Flier and Round-the-World Solo Celebrity, with N.A.A. Model Plane Championship Trophies.

Even when the model seems to be flying level, it may be not quite level, in which case it is slipping toward the side that needs a little more incidence.

The following is the most important part of the adjusting, for it is at this stage that you should get the model to fly smoothly and efficiently. Follow the model around about five feet to the rear, or allow the model to fly directly toward you. This will assist in discerning any trouble.

3. Now comes the attempt at duration, presuming the model is in fair flying trim.

(a) Wind fully and let off 1/3 the power. The model should climb but not much. This is just to check to prevent the model from immediately going through the roof.

(b) Keep winding fully but letting off less each attempt until the model succeeds in getting near the ceiling. It should land with about 100 turns in the rubber from near the ceiling. If it comes down dead stick, you are either not winding tight enough or you have too much power. If it lands from near the ceiling with too many turns in the rubber, you have too little power. At this stage pay no attention to how much power you may have to let off to keep the model from hitting the ceiling; what you are interested in is how much power it has when it lands. If the model has too much climb, lengthen the motor or use lighter rubber or a larger prop. If the model has too little climb, shorten the motor or use a prop with less pitch. It is astonishing what a few inches off or on the motor will do to the climb.

(c) If model stalls when wound fully, bend the thrust bearing slightly so the prop is pulling down and then begin by winding 1/3 and moving the wing till its stall position is found. Any other procedure is a waste of time.

(d) If model flies fast when wound fully, bend the thrust bearing slightly so the prop is pulling up. Begin over then as mentioned above.

4. Troubles and their cure.

(a) Instability. There are many kinds of instability but only a few affect models as a rule. The tail boom should not be floppy, but a stiff hollow spar. If the boom is too floppy it causes the model to stall at one time and dive at the next. The model should be stable in proper adjustment if

$$\frac{\text{Stab. area} \times \text{stab. distance}}{\text{Wing area} \times \text{wing chord}} = \text{at least .5 (one half)}$$

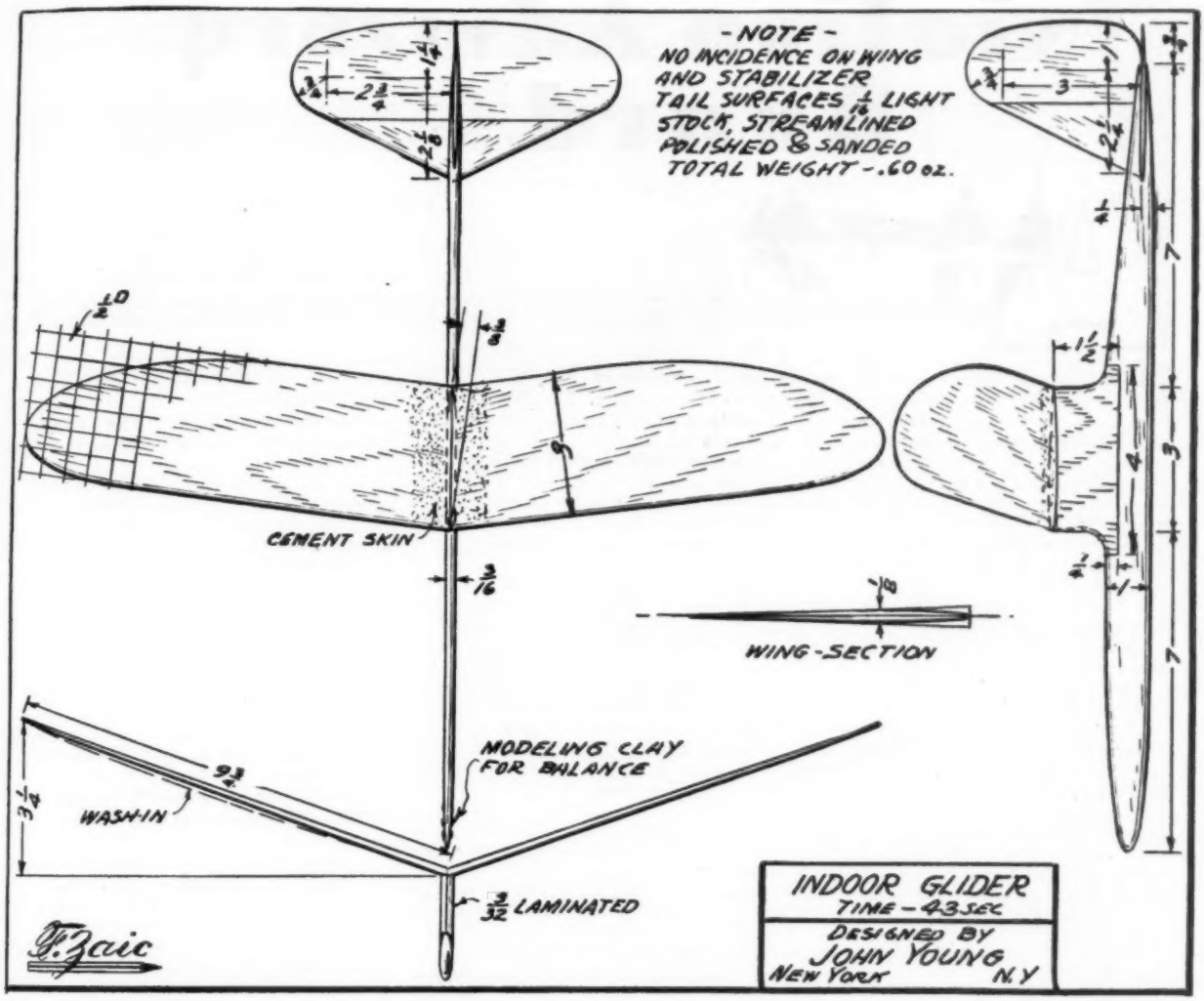
(b) Though it seldom happens except on scale models, too small a tail will have the same effect as a floppy boom.

(c) Moving wing forward decreases stability. The wing can be made to balance farther back if the boom is warped up. However, do not warp the tail up very much as this increases drag and decreases efficiency.

(d) Do not use too little dihedral. Too much will not hurt greatly but too little will make the model skid.

(e) If wing tips are floppy, wing tip stabilizers are in order if you are positive the trouble is not due to washed out tips. Wing stabs should not be used unless spars are very floppy and then only on the offending tips. Make the boom for the wing stab at least as long as the chord of the wing at the point where used. The stab area should equal the square of one half the wing chord. The stab should be flat on its boom but the boom should be set so that the stab has 8 to 10 degrees negative incidence.

(f) If model "flies over the hump" when wound fully it is usually due to too little negative incidence angle on the stabilzer. The trouble may be caused by the bending of the motor stick which decreases the angle difference between the wing and stabilizer. Use a stronger stick, or put a longer boom on the stick, or give the stabilizer more negative incidence.



N.A.A. CLASS B INDOOR GLIDER

Designed by John Young

Unofficial time—43 seconds

Notes On Construction and Flying

This glider was designed with the following points in mind, stability, minimum drag, and strength. Stability is incorporated by using a high wing, large tail surfaces and sweepback. The high wing also insures perfect recovery into gliding position at the top of the throw.

To minimize drag, careful attention has been given to airfoil sections of wing and tail surfaces, both of which are streamlined. Skin friction has been reduced by careful surfacing with very fine sandpaper and banana oil. Several coats of banana oil were used, the first being permitted to soak into the wood and when dry smoothly sanded. Sand between each coat. The final coat should be rubbed with fingers until a smooth surface results. To give the final finish, the surface was polished with the back of the sandpaper.

As this model has to withstand baseball-like launchings, wood of generous size is used throughout. Fuselage and wing are medium grade balsa; tail surfaces are lighter. Credit is given to Colman Zola for the idea of using a wide band of cement to strengthen the center of the wing. Use enough to form a tough skin.

The duration of flight of an indoor glider depends on adjustment and height attained in launching. Adjust by giving washin as shown in drawing. Set fin for left circle. These adjustments cause model to climb sharply when hurled in launching. The glider is launched similar to the underhand baseball delivery, in such manner that it leaves the hand at about 30 degrees climb and 45 degrees right bank. This causes the model to climb in a banked spiral. When the launching impulse is expended the model has reached the top of its climb where it straightens out and wings into a wide left turn and rather flat glide.

Aviation Advisory Board

Conducted by
CHARLES HAMPSON GRANT
Chairman of the Board
Formerly of
The Technical Section, Air Service, U.S. Army

MANY of our readers send in questions to us which are very long and involved. In such cases we have not been able to consider them for answering in the Advisory Board as a great deal of research is necessary and too much of our space is taken up. In answering questions hereafter, will our readers be concise and state their questions briefly and clearly? This will enable us to answer more questions with less effort.

Roland Pastermack of 331 East 86th Street, New York City, asks us:

Question: What is the advantage of balanced control surfaces?

Answer: When control surfaces are balanced the center of pressure on the surface is close to, or is exactly at, the axis at which the control surfaces are hinged. The pressure on the surfaces, therefore, is not transmitted back through the controls to the control stick. Unbalanced surfaces cause considerable reaction on the control stick, which must be overcome by the pilot holding the stick in large ships or on long flights. This is very tiring as it causes the pilot to use considerable strength in operating the controls.

Question: What do the initials N.A.C.A. stand for?

Answer: They stand for National Advisory Committee for Aeronautics.

Readers very often ask questions in the Advisory Board which may be easily answered by merely looking through the pages of our magazine. For instance, Peter Cossette of 48 Daly Avenue, Ottawa, Canada, asks us:

Questions: What is the formula for finding the area of a propeller? How is it possible to find the center of gravity on a model plane? What is the moment arm in aerodynamic design, and how is it found?

Each one of these questions is answered clearly and at length in the articles, "The Aerodynamic Design of the Model Plane." Repetition merely takes up valuable space. If readers do not have the issues of the magazine in which the articles appear that deal with the questions that they have in mind, they may write into this office and purchase copies. We will be glad to tell any readers in what issues the answers to their questions appear, if they will write to us.

Morris Kramer of 2765 Matthews Avenue, New York City, wants to know the following:

Question: What is the relation between the weight of a motor and its horse-power?

Answer: There is no definite relation between the weight of a motor and its horse-power. The object of motor designers is to make the weight as little as possible for the horse-power developed. The average motor weighs from two to two and one-half pounds per horse-power. However, some motors have been built which weigh much less.

Question: What is the relation between the horse-power of a motor and the propeller area?

Answer: There is no definite relation between these two factors, without consideration of the drag of the airplane, the diameter of the propeller and its pitch. All of these factors are correlated.

Question: Is a slow propeller more efficient than a fast one?

Answer: Yes, the slower the speed, the less the ineffective disturbance created by the propeller. When a propeller revolves slowly, the air flows into it with much less disturbance. There may be other reasons, but the one given here can be simply understood. Other more involved factors enter the problem.

Question: What is the relation between the wing area and the pay load of an airplane?

Answer: There is no relation between the wing area and the pay load of an airplane. Usually every airplane is different in this respect. The total load that an airplane carries per square foot of wing area ranges from six pounds to twenty-one pounds per square foot. Usually, the wing loading per square foot determines the speed of the airplane.

Question: What is the highest altitude a flier can go without the aid of artificial means of breathing?

Answer: This depends upon the flier himself. Some people are easily affected by altitude, others are not. Usually it is necessary to use oxygen from 15,000 feet up. The higher the altitude, the more oxygen will be necessary to sustain the pilot in a normal condition.

Walter March of 4436 South Washtenaw Avenue, Chicago, Ill., asks the following question:

Question: What causes a twin pusher that flies level at the beginning of a flight, to start stalling when more than half of the rubber is unwound?

Answer: It is very difficult to diagnose the causes of trouble in a model without full information regarding its design and how it has flown. This would even defy the cleverest magician. However, such an action as mentioned in the question may be caused if there is more dihedral on the rear plane than on the front plane, or where there is more camber on the front plane than on the rear plane. Will our readers in asking their questions please

Here is the largest land-plane in the world, the Maxim Gorki, built in Russia. It has eight engines and carries a complete radio and printing outfit for distributing propaganda. The wing span is nearly 200 feet

give the design characteristics of their models with an exact description of the performance of the models under various conditions? This will aid greatly in giving an intelligent answer.

John H. Campbell of 23 Sandusky Street, Plymouth, Ohio, has some very interesting questions. Here they are:

Question: What is positive and negative stagger and how is it used?

Answer: Positive stagger is that condition which exists in a biplane when the leading edge of the upper wing is set forward of that of the lower wing. Negative stagger is where the leading edge of the upper wing is to the rear of the leading edge of the lower, as in the case of the Beechcraft.

Question: Do you need to have as much dihedral on a gas model as you do on a rubber-powered plane?

Answer: Yes, this is very essential. The dihedral on a gas job is more important than on a rubber model, as a gas model often will have a tendency to spiral dive.

Question: What is the reason for the gull wings on the Polish Fighter?

Answer: Gull wings on this ship serve two purposes. One, it is more efficient than if the wings contacted the body in a straight line across its top; or if the ship were a parasol type, because when the wing contacts the body perpendicular to its surface, as in the gull wing type, less turbulence is created about the fuselage and the air flow over the wing is smoother. Another good reason is that there is no "blind" spot directly in front of or above the pilot. In military ships this is important.

Question: Would it be practical to cover an airplane that has a wing span of 32 5/16", with silk?

Answer: We were not aware of the fact that this particular measurement of wing span precluded the use of silk. Planes with wing spans as low as twelve inches have been covered with silk and have flown successfully. We cannot see any reason why there should be doubt in your mind as to the successful operation of a plane of this size covered with this material.

Roger Beaupre of 121 Locust Street, Holyoke, Mass., wishes to know:

Question: What is an adjustable pitch propeller and why is it used?

Answer: An adjustable pitch propeller is a propeller the blades of which may be adjusted at will to a greater or lesser pitch. This is done by loosening clamps at the hub into which the blades fit. The blades may then be adjusted to a greater or lesser angle, after which the clamps are tightened. This type of propeller allows the pilot to adjust it for varying air densities and conditions which the plane has to meet. This adjustable feature also allows such a propeller to be used on different types of ships with various horse-powers. The blades may be adjusted to meet the difference in design.

Question: How can one find the area of a wing like the one on the Hall-Springfield Racer?

Answer: This question has been answered in our Advisory Board in a previous issue. Briefly, the wing plan surface should be divided into squares and triangles. The area of these should then be calculated and

(Continued on page 48)

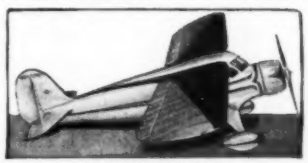
LEARN AVIATION

By building these beautiful Super-Detail Flying Planes . . . designed by flying men . . . in exact scale.

Another NEW Super-Detail model . . . the Italian liner REX.

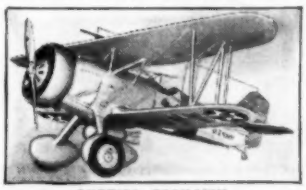
29"—scale 1/32" to the foot.

Shaped hull and over 100 metal fittings. 24 cast metal lifeboats; 24 cast stairways, 2 cast anchors; 4 metal propellers; 6 cast bits; 48 metal davits. The Rex comes in beautiful high luster original colors of black, orange, white, red and green; and the kit also contains turned wood parts, printed wood, cement, wood filler sandpaper, etc. Full sized plans with complete instructions and 7 photographs illustrating the different stages of construction. All the hard work has been done for you.
Kit complete, postpaid..... $6.00



STINSON RELIANT

Wingspan 32 5/16", length 21¼", weight 3½ oz., exact ¾" scale. Adjustable speed arresters built into the wings, the movable cabin doors, the complete interior with four seats and control column, and all the other Super-Detail features. Colored in bright contrasting yellow and black. **Kit complete, postpaid..... $2.50**



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Acrobats of the Sky

(Continued from page 5)

amount of resistance to the forward motion of the plane. Hence, in recovery from a spin, the pilot shoves his control stick completely forward and he should kick full opposite rudder. The importance of this maneuver is stressed in the ditty known and sung amongst pilots:—

"When in danger or in doubt,
Nose her down and pull her out."

Peculiarly, on many occasions after a pilot has spun into a crash, he has declared that his control stick was all the way forward. The explanation of this generally is that during a spin the pilot is violently thrown far back in his seat and kept there by centrifugal force. He reaches as far forward with the control stick as he can, but this is not in the full forward position. Consequently, full down elevator was not applied and naturally the plane spun in.

Normally, a pilot can estimate a loss in altitude of 500 feet for every full turn of a spin. Thus, if a plane were to fall into a spin under 500 feet, it would be impossible to regain control. As a matter of fact, if the pilot were to try he would probably find himself in a dive towards earth at such a low altitude that he could not resume level flight. Thus, there is definitely an altitude at which it is better to remain in the spin than to attempt to recover. This altitude will vary with the skill of the pilot and the type of plane he is flying. This explains the saying which is current around aviation fields that the first 500 feet are the hardest.

A sensible pilot will make sure he has plenty of flying speed until he has reached an altitude which will permit him to recover from a spin. As a matter of fact, he will always maintain flying speed. It should be an insult to a pilot's skill for him to lose control unintentionally no matter at what altitude. This will preclude steep climbing turns on the take off, a maneuver invariably done to "show-off" to a crowd. To prevent the necessity for this, the pilot should invariably taxi to the far end of a runway before taking off as this insures plenty of altitude to clear any obstacles at the edge of the field.

Similarly, on an approach for a landing, the pilot should be unusually cautious when nearing the ground. He should keep his engine cleared out to avoid losing his power should an emergency arise such as maneuvering to avoid a plane which is cutting in front of him. Should he be required to pull his ship up quickly with a choked engine he might very easily lose control. He should be careful at all times, but especially when within 500 feet of the ground. As a matter of fact, no acrobatic maneuver should ever be done except at an altitude which permits control of the plane at not less than 1500 feet. This will allow for errors and unforeseen difficulties which might conceivably arise.

It has been seen that the spin begins with a stall. As a matter of fact, from an aerobatical point of view, the stall is the beginning of many other maneuvers which are included in the repertoire of a skilled stunt flyer. The falling leaf, for instance, is but a series of partial spins, alternating in rapid succession first one way and then the other. The plane is stalled with the control stick held clear back. Rudder is applied to start a spin and just as the plane falls off on one wing, full opposite rudder is quickly applied. This brings the first spin to a halt and the opposite wing falls away into the beginning of a spin. At this point, quick opposite rudder is again applied. This is continued as long as the maneuver is desired. The difficult part of this evolution is to make the two portions of the spin symmetrical about some central line. In other words, the ship should always be heading in approximately the same direction.

Snap barrel rolls are also of the stall family. As a matter of fact, this stunt is nothing more or less than a horizontal spin and if the ship is kept into a rolling condition, it will eventually work into a spin as the engine begins to pull the nose down. In the roll, the ship is stalled as in the spin, but with more speed, which serves to give a rotating motion. To do it accurately, the pilot must stop his craft's turning motion as it resumes normal level flight. Some ships roll exceedingly rapidly while others lumber around very slowly and clumsily.

The roll is generally done at a speed about 20 miles higher than the stalling speed of the plane. The control stick is pulled entirely back sharply and as the nose rises, full rudder is kicked in the direction it is desired to roll. In some sluggish types of craft it may be necessary to apply full aileron as well to obtain a good roll. The ship then assumes a horizontal spinning motion and the pilot must be ready to gain control as his ship rolls up to the horizontal. To recover control all opposite controls are used. That is, the stick is pushed sharply forward, opposite rudder and aileron are applied. The trick of the roll is to know when to apply opposite controls. This is a matter of experience with any particular type of plane and it may require a certain amount of practice before accuracy is obtained by the pilot.

A double snap roll is similar to the single snap barrel roll. However, another 30 miles of speed will be necessary to begin the maneuver. The controls are handled in exactly the same manner except that they are held full on until the plane has completed its second roll. It is quite possible to get a third roll out of a plane, but a tremendous amount of initial speed is necessary and this results in high wing stresses. It is a maneuver not recommended for other than a pursuit ship. A modification of this maneuver may be achieved by first climbing vertically after a long dive and performing the maneuver when in the vertical position.

One of the most beautiful variations of the stall is the roll on top of the loop. Here the pilot begins a loop with a fair amount of excess speed. Just before reaching the top and when on his back, he pulls his stick sharply to him and at the same time kicks hard rudder. His ship goes into a fast stall and rolls completely over. The pilot stops the roll when he again regains the inverted position and completes the loop.

Still another application of the stall is the split-S. This maneuver has no practical application but is excellent training for a pilot. The stick is pulled sharply back until the plane is climbing steeply.

Just before the craft is completely stalled the rudder is kicked. This causes the ship to pivot quickly in the direction of the applied rudder. When standing vertically on its nose, neutral rudder is applied and the plane is pulled out of the dive. Thus, it is seen that the pilot has reversed his course by means of the quick pivot at the top of the stall.

There remains one more form of the stall—the inverted or outside spin. This maneuver remained more or less of a mystery until Al Williams began to study it extensively. Many times it happened that pilots found themselves gyrating madly about in a ship which failed to respond to their efforts to regain control. Either the pilot crashed or he was forced to bail out. Williams found out that in this evolution, the ship had been stalled in an inverted position. Then, as the spin developed further, the pilot was on the outside of the spinning vortex. Obviously then, in order to regain flying speed it was necessary for him to pull the stick towards him as this would bring the ship into a dive.

To do this spin deliberately, the ship is placed upon its back by a slow roll or by making half a loop. Then the stick is pushed steadily forward until the plane is stalled. At that point kick full rudder. When in the spin, the tendency is for the pilot to be thrown out of the cockpit. Unless the aviator has had some experience with this type of spin, he might very well become confused. Recovery, however, is very easy in a normal airplane. Regain flying speed by pulling the stick towards the pilot and stop the rotation by kicking opposite rudder. The ship then comes out of the spin into a violent dive.

Thus, it is evident that practically all stunts seen at an air show are merely variations of the spin and the loop, or a combination of these two maneuvers. The pilot who appears to have the largest repertoire is merely one who goes from one evolution to another with no time interval in between. Moreover, he manages to combine these stunts in such a fashion that they appear to be entirely new. Actually, all he has done is to loop and spin his ship. The skill comes in doing these maneuvers accurately and smoothly.

The Le Pere Fighter

(Continued from page 8)

made construction and rigging somewhat simpler.

This plane was just being placed into production at the termination of the Armistice by the Packard Motor Car Company. The original plane was powered with a Liberty 400 h.p. engine although subsequently in later years improved Packard engines were tried. It is of interest to note that this plane slightly modified, succeeded in bringing to this country the speed records for planes at over 30,000 feet as well as the world land plane altitude record of approximately 34,000 feet. Even today this plane if fitted with a modern liquid-cooled engine would easily be a serious competitor to modern observation machines in performance.

The flying qualities of this machine were excellent and in later years it was acquired by the N.A.C.A. for engineering work and

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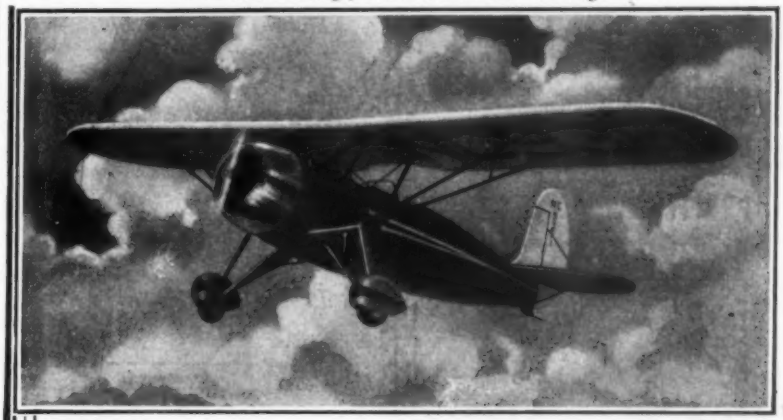

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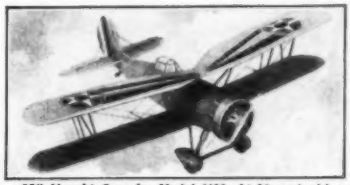

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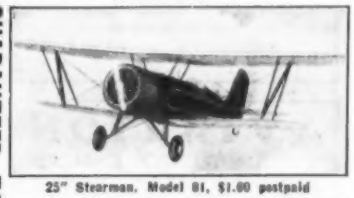

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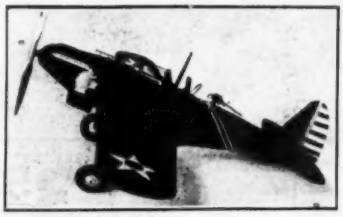

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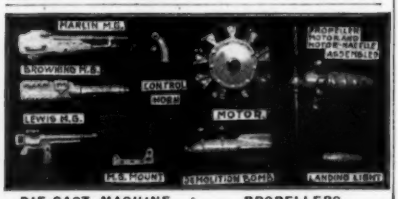

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acquitted itself worthily. Lieutenant John L. McReady, now of the Shell Oil Company of California, made many successful record flights of international importance with this airplane and many of the engines in use today have derived the benefit of the supercharger data this plane was instrumental in carrying out at a high altitude. This plane immediately after the war was flown in the Liberty Engine Builder Trophy Races and took several prizes.

To the writer's best knowledge, this machine is spending its old age as a silent memento of the fact that not all of the American wartime machines were of the "flaming coffin" variety so readily attributed to the wartime aero program. The machine is resting after a strenuous life of nearly 7 years in the aeronautic museum in the Government Laboratory at Wright Field alongside Lt. McReady's other pet "ship" the Fokker T-2 of transcontinental flight fame.

More About Microfilm

(Continued from page 15)

periment. After this is added, the bottle is again shaken and the solution is ready for use. The cap of the bottle may be used to pour the solution onto the water.

If the film is oily and does not wrinkle at the edge within 15 seconds, too much solvent has been added. Therefore add more base. If the film is not flexible enough, add more plasticiser. This procedure is followed until a mixture of the right consistency is gotten. I then record the number of drops of each chemical, in order that I might duplicate the solution when required.

A number of indoor fuselage models having paper braced, microfilm covered fuselages, made their appearance at the 1934 indoor national meet held in Akron, Ohio. Picture No. 1 illustrates the model I used in breaking the Class B record, with a flight of 12:23. In order to cover this fuselage, I had to add enough pasticiser to make the film flexible in order that it might reach the roundest portions of the frame.

In conclusion, I want to suggest and urge that rather than purchase your microfilm solution, you experiment and develop your own. The knowledge of cellulose chemistry acquired in this experimentation is well worth the time spent. One can obtain, thus, a solution as good or better than any of the ones being sold today. It is work such as this that furthers the science of model aeronautics.

Slipstreams

(Continued from page 25)

plane taking off by its own power and "going places" in a hurry, to come down afterwards to a perfect three-point landing.

"Of course, to get those results it is necessary to have a great deal of experience and study; that is, good working plans, materials, tools and constructional ability, as well as a complete understanding of the fundamentals of flying and dangerous flying attitudes; also how to correct them, building *real* stability into them. (I make this statement because some model builders are thinking of "stunting" their little planes or trying to force them into some other performance, before obtaining good, efficient models.)

"There is another reason that makes model building so popular throughout the world. Scale models are ideal for display and exhibition purposes. They are very impressive when well finished (especially when they show a great amount of minor details), chiefly because almost everybody thinks of the airplane as the symbol of the spirit of progress of the day and age.

"All these facts explain 'why' I like to build model planes. Now I will talk about which model planes I like to build, and 'why.'

"I think that in order to obtain the full benefits credited to model plane building and flying in advancing big size ships' efficiency by improvements of design and aerodynamical refinements, we should aim at the duplication, as faithful as possible, of real plane construction and flying. A small gasoline engine driven model is the goal to reach, of course, but I don't mean exactly that. (Not even a compressed air model.) The usual rubber motor universally accepted is the one which offers the biggest power-weight ratio. It is the cheapest and less breakable and meets all the requirements from the experimental point of view. Besides, a gasoline model is quite a lavish idea.

"Although these considerations force us to accept wound rubber motor policy, it should not be sponsored, because it determines a substantial change in design, as the distribution of weight along the fuselage is absolutely different from that of the big ships. The stresses imposed upon the structure are equally different, as well as other factors.

"But there are some questions of the utmost importance to be considered first. is the actual feather-weight construction worth while? Does it suit the conditions of *'experimental tool'* that are the chief advantages of model building and flying? I SHOULD SAY NOT!!

"If we make a model plane following the standards of construction of *extreme* lightness which seems to be so much in favor, we can get swell endurance records, but the aeronautical knowledge obtained from our efforts is NOT what it should be, because these models do not promote an intensive study of airplane design. They can fly using any propeller, even the most crudely built (as a matter of fact, they invariably have the same blade cross-section and the same pitch angle from hub to tips), having careless construction and rough covering. And those who follow out these rules, get their records mostly with the aid of rising air currents: they are merely *floaters!*

"That is why I like heavy models; models of limited flying time, WHOSE PERFORMANCE YOU WILL HAVE TO INCREASE THROUGH BETTER DESIGN, AERODYNAMIC EFFICIENCY AND PAINSTAKING CAREFUL CONSTRUCTION, and getting only a minimum of help (or no help at all) from rising air currents. Those models would not overcome designing deficiencies by means of high power-weight ratio. (Excessive power will pull the plane through the air regardless of the lack of true flying characteristics.)

"A white pine or spruce model is light

enough, strong and not hard to build, and balsa wood can be used to some extent as an aid. However, if the builder is used to balsa work, he can make the whole plane out of it, but getting more strength and weight using greater number of wing ribs, stringers, and more substantial spars and formers. Believing that 'speed' is one of the most desirable characteristics of an airplane, I favor the construction of fast models. I do like also flying boats (which seems to be somewhat neglected), amphibians, and odd designs, such as rotor planes, tailless planes, helicopters and what not.

"The field for research has no limit, and model plane building is the most promising method to follow if we wish to obtain a constantly increasing development in airplane progress."

(Is there not lots of "food for thought" in the preceding lines?—*Editor.)*

On the Frontiers of Aviation

(Continued from page 14)

the past. Strength has been added to the wing by the cabane struts under the fuselage.

The cockpit of the "Irish Swoop" has provisions for two men with parachutes, sitting in tandem fashion in all-metal, bucket-type, shock-absorbing and self-adjusting Bendix seats. The front cockpit contains complete navigation and engine instruments, controls for plane and engine, landing gear retraction control and mechanism, dump valve cranks, etc. The rear cockpit contains a directional radio receiver and a few other instruments. The power plant is a double-row 14-cylinder Pratt & Whitney Wasp Jr. engine of 700 h.p. An oil cooler is built into the leading edge of the tapered wing. The wing and steel tube fuselage are fabric-covered. The landing gear used is a Bellanca development of 1927 and has proved to be very efficient. The ship's performance is as follows (from actual test):

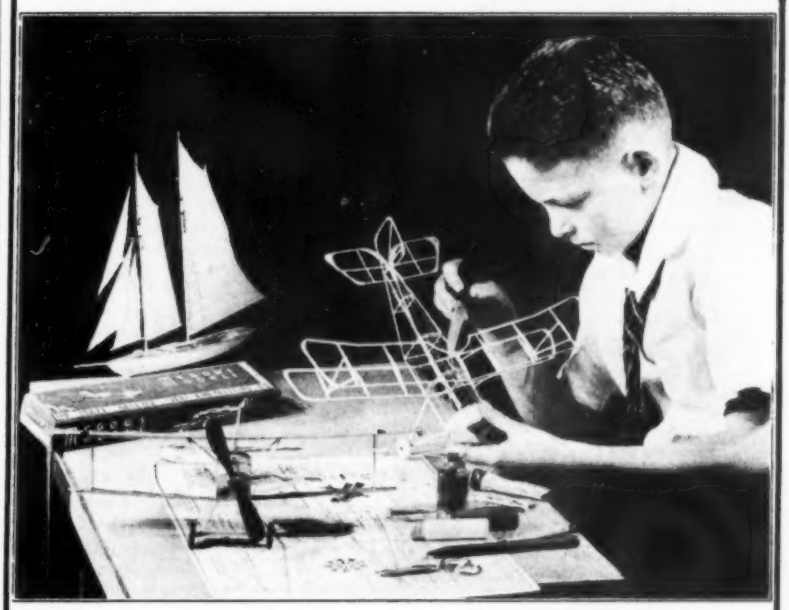
High speed at 9000 ft.	257 m.p.h.
Cruising speed	233 m.p.h.
Rate of climb	1980 ft./min.
Range:	
With 7,000 lb. gross weight	2075 miles
With 8,350 lb. gross weight	3365 miles

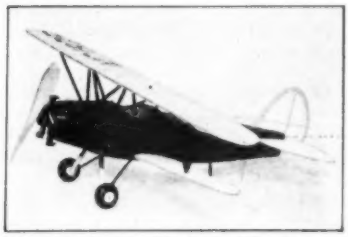
The three DeHavilland Comets are of unusually excellent design. The DeHavilland Company had plenty of time to test their racers before they entered the race. Many small details have been changed in them since their completion. But even at that they were not as successful as they might have been. The winning Comet of Scott and Black, however, showed a fine performance and deserved to win the MacRobertson Race. The Comet's performance follows:

Top speed (1,000 ft.)	235 m.p.h.
Top speed (10,000 ft.)	225 m.p.h.
Range	2700 miles

The success of the Comets has led British designers to the belief that transports and bombers can be built along such lines. The DeHavilland Company will undoubtedly put out a transport similar to the Comet in the near future.

Kingsford-Smith had intended to enter the MacRobertson Race with his new Lockheed, but then he changed his plans





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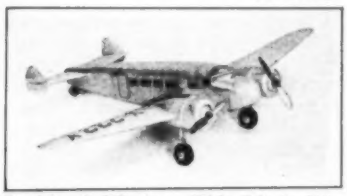

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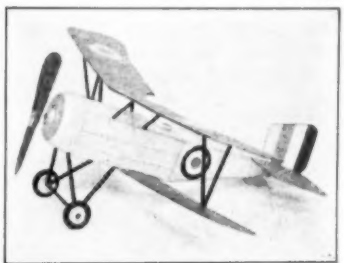

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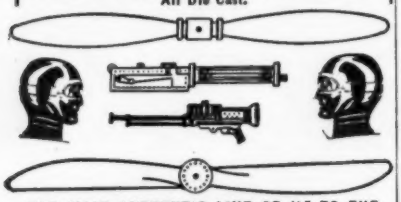

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DeHAVILLAND "COMET" London to Melbourne race winner. See page 6 Jan. U.M.A.N., 50 cents

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S.E.5

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The above are actual photos of MODELS
35 cents each **3** for $1.00
Any **7** DeLuxe Kits $2.00
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Standard Kits 25 cents Ea.
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EACH KIT CONTAINS:
Liberal portions of colored lacquers and cement, finished pine wheels, colored insignias, rigging wires, most difficult parts cut to outline shapes, detailed drawings, etc. The greatest value ever offered at any price.
EASILY ASSEMBLED, SIMPLIFIED CONSTRUCTION. WORLD FAMOUS PLANES.

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The kits to build these large authentically detailed models contain, all parts cut to outline shape, finished pine wheels, colored lacquer, wood filler, colored insignias where needed, completely detailed drawings, etc. (No cast parts).

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$1.00 plus 10 cents postage.

AIRCRAFT 4911C Cornelia Ave. CHICAGO, ILL.

and made the successful crossing of the Pacific Ocean. The performance of his plane is on a par with that of the Comet's.

The two Vultee transports entered respectively by George R. Hutchinson and H.W.G. Penny did not compete in the London-Melbourne race. If they had, they would have been sure winners. Hutchinson's plane has been equipped for regular trans-Atlantic service. He expects to purchase a fleet of seven Vultees before beginning operations. His present Vultee has room for two pilots, in back of which is a small compartment for strong extra gasoline and in back of that is a long table on which is a large sending and receiving radio set. Room for two passengers is also available in this rear compartment. Most of the pay-load will consist of mail. The entire fuselage and vertical tail surfaces are squared off on the Vultee with black lines and advertisements have been inserted in the squares.

The winning of second place by the American-built Douglas and third place by the American Boeing has proved the wonderful performances of our transports. The features of the Douglas are well-known, but those of the new Boeing 247-D that Turner & Pangborn flew with radio-operator Nicolls, are not. The ship is a revamped version of the original Boeing 247. The windshield slants opposite to those of previous design as is also the case with the new Lockheed Electras that are now being completed. New geared Wasp Hs with full N.A.C.A. cowls substitute the older Wasps with cowl rings. The increased performance of the Boeing 247-D follows (full load):

Cruising speed	184 m.p.h.
Landing speed	60 m.p.h.
Initial rate of climb	100 ft. per min.
Take-off run	740 ft.
Service ceiling	21,400 ft.
Wing loading	15.64 lb. per sq. ft.
Power loading	11.91 lb. per h.p.

A new model of the Douglas transport is to appear in 1935 with many improvements over the former DC-2s.

As we go to press Laura Ingalls' Lockheed Orion has reached the final assembly department. She will attempt some spectacular flight in it in the near future when it is completed.

The Uppercu-Bernelli long-distance plane (January issue, U.M.A.N. page 6) for Clyde Pangborn is nearing completion. Pangborn expects to circle the world in 104 hours in it with only one stop en route!

Pangborn also intends to break the landplane speed record in a Vickers Supermarine S-66 which won the Schneider Trophy Race in 1931. He is bringing it to this country from England and will equip it with a land gear and a new engine.

"Matty" Laird, famous racing plane designer, has built a new sesqui-plane with features similar to that of the Stinson Reliant. It is very fast. We will try to bring you further news of the plane next month.

Pitcairn has completed the first of their new two-place cabin autogyros. There are no wings employed and the ship has a rather fast speed for a low-powered 'gyro.

Professor August Piccard is having a new balloon built which will be the largest in the world, even larger than the Stevens-Kepner-Anderson balloon! Prof. Piccard hopes to reach a height of 18 miles. The balloon's capacity is 147,804 cubic yards.

Two new giant trans-Atlantic flying boats are being built in France. The smaller of the two is a Bleriot. M. Bleriot was in this country recently and brought us news of his latest venture. He does not speak English and therefore it was difficult to obtain any definite facts about the ship. There were a hundred or more different interpretations about what he had to say, but we have tried to gather together a few of the more well-defined facts. It is a three-engined plane that will carry 20 passengers and is designed to land safely in a moderately rough sea.

The other French plane will have a 165-foot wing spread and 105-foot length. Four engines will power the huge flying boat with 64 passengers and 6 in the crew. It will be the largest plane in the world!

M. Flandin, recently made premier of France, is a very air-minded person and has spent most of his life in the interest of aviation. He should do much during his period of office for the development of new type planes, which are much needed in France. A new fast Dewoitine has been completed and several will be delivered to the French air forces in the very near future.

The Bureau of Air Commerce's call for bids on a light sportplane has had great results. The Hammond Aircraft Company received the Bureau's order for 25 of their new ships. The plane is a two-place, low-wing pusher with an in-line engine in the rear of the passenger cabin. The tail is on outriggers. Landing speed is 37 m.p.h. and high speed is 118 m.p.h.

Another new interesting sportplane is the Curtiss Sparrow. It is a low-wing, two-place enclosed tractor monoplane. The landing gear is enclosed in a fairing similar to those on Northrop planes. Top speed is 127 m.p.h. and landing speed is 35 m.p.h. The ship is of all-metal construction.

Spartan's new ship, powered by a Warner Scarab, has a speed of 145 m.p.h. This plane is also a low-wing with a retractable landing gear.

Amphibion's, Inc. has produced a new all-metal Privateer with a 450-mile cruising range. Its high-speed is 115 m.p.h. and cruising speed is 102 m.p.h.

Both the Privateer and the Hammond have a small wheel in the nose to replace the one in the tail.

Negotiations have been completed between Mr. Mark Kleedon, Oklahoma City oil man, and Wiley Post for the formation of the Wiley Post Aircraft Company. The newly formed company will manufacture light planes.

Build Solid Wood Scale Models of the DeHavilland Comet and Bellanca Irish Swoop

The three D. H. Comets that participated in the MacRobertson Race had different paint jobs. The Mollisons' plane is black with gold lettering; the Scott and Black plane, red with white lettering; and Cathcart-Jones and Waller plane, green with white lettering. American Hamilton Standard propellers had been intended for

use on the Comets, but designs for a small-size prop which was needed for the Comet engines were not completed in time. French Ratier automatic two-pitch propellers have been used instead. The rest of the plane is English-built and designed.

Balsa wood should be used for the construction of both models. Get dimensions for purchasing material from plans. It is preferable to purchase the wheels as they are rather difficult to make.

If you desire to square off the plans, connect up the corresponding dots on the border with light lines. Each square will equal one foot.

The tools needed will be a small sharp chisel, a jig-saw, a razor blade, fine and coarse sandpaper and paint brushes. A tube of ambroid should be used in connecting the various parts of the models and black thread used for wiring the wing and tail surfaces of the Bellanca. Also purchase some dope or lacquer. Colors are optional.

In constructing the model or models make the fuselage first, then the wing, then the tail surfaces, then the engine nacelles in the case of the Comet, and then the miscellaneous other parts.

Trace the outline of the various parts on paper and then lay the paper on stock. Go over the outline once more, pressing heavily so as to make a groove in the wood. Cut around this outline with your jig-saw and go over the surfaces with coarse sandpaper. Then draw on the other outline of the piece, that is, if you have drawn the side view of a part on the wood, then draw the top view or vice versa. Cut around this other outline with a jig-saw and then shape out the rest of the piece with a chisel (or pen-knife), referring constantly to the various cross sections.

Use thin strips of balsa for making the panels on cabin enclosure. Cellophane may be used as window glass.

The wing may be made in two halves and ambroided to the sides of the fuselage later. The wing fillets may be made of putty if so desired.

Sandpaper all parts of the model first with coarse sandpaper and then fine sandpaper. Brush all the dust off them and then begin the paint job. The more coats of dope or lacquer you put on, the better the finish. Always let the first coat dry before applying the second. A smoother finish may be obtained if you go over the surfaces of the parts with fine sandpaper after applying the first coat. Lay parts aside to dry and then begin the assembly.

In the case of the Comet, ambroid the engine nacelles to the wing first and then the wing halves to the fuselage. Put blocks under wing tips to hold them in correct position. In the case of the Bellanca, the wing may be connected immediately. Use plenty of ambroid. Join the vertical tail unit to fuselage next and then the horizontal, with blocks holding them in place.

Lay the model on its back and put on the landing gear as shown in the plans, which is a very simple procedure. Connect the prop to nose with a small straight pin, which will act as a shaft. Connect up any wiring that is to be done and then touch up all connections with dope and ambroid. The model will then be complete.

Build This World Record Glider

(Continued from page 7)

edge, sand it to shape and glue to each rib. Next the ⅛" square leading edge is added and glued on. Notice it is set in the ribs diagonally and the front edge is sanded to shape. The other half of the wing is made in the same manner. The easiest way to join the halves is to lay one-half flat on a level board and prop up the other tip seven inches. The spars are then cut to fit and glued. A piece of 1/16"x¼" long is glued to each side of this joint for strength. The leading and trailing edges are both joined and glued. Allow this to dry for at least 90 minutes before removing it from the board.

Stabilizer

Lay the 1/16" square leading and trailing edges over the drawing and glue in the stabilizer ribs. The stabilizer is made in one piece.

Rudder

The rudder is made entirely of 1/16" square balsa and can be made directly over the drawing.

Assembly

The wing can now be covered, half at a time. The top should always be covered first as it is better to have it warp up than down. The best thing to do is to cover the top of the wing with white superfine paper for lightness and the bottom red for visibility against the sky. The

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Pint 90

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Used on real ships for cutting down wind resistance. A beautiful addition to any radial motored model.
1" diam. 19
1½" diam. 19
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2½" diam. 26
3" diam. 29

12" SHEET ALUMINUM
.005 per ft. 12
.010 per ft. 19
.032 per ft. 12

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Strong and light, large size. .035 hole ..... .02
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1" diam. hardwood unbreakable, pair 5c

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1¼" diam. ..... pair .11
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Celluloid, 9 cylinders, 3" diam.
Each ..... .35
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20x24 ..... 3 for .08
Doz. ..... .27

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⅛x3/16 ..... 8 for .05
⅛x¼ ..... 6 for .05
⅛x⅜ ..... 4 for .05
3/16x3/16 ..... 6 for .10
3/16x¼ ..... 6 for .11
¼x¼ ..... 6 for .12
¼x⅜ ..... 6 for .13
¼x½ ..... 6 for .14
⅜x⅜ ..... 6 for .15
⅜x½ ..... 6 for .16
½x½ ..... 6 for .17
½x1 ..... 6 for .20
1x1 ..... 2 for.12

18" SHEET BALSA
1/32x2 ..... 2 for .03½
1/16x2 ..... 2 for .04½
⅛x2 ..... 2 for .06
3/16x2 ..... 2 for .08
¼x2 ..... 2 for .10
½x2 ..... 2 for .18
36" lengths may be had

If desired at above prices but for half quantity.

40" Lengths
⅛x⅜ ..... .05
⅛x½ 06
3/16x⅜ ..... .07
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1x3x36 ..... .30
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⅝x1⅛x8 ..... 3 for .08
⅝x1⅝x10 ..... 2 for .09
⅝x1⅝x11 ..... 2 for .11
⅝x1⅝x8 ..... 2 for .11
⅝x1⅝x11 ..... 2 for .12
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No dummy motor needed with this cowling.
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3" diam. ..... .30

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.045 sq. 25 ft. ..... .08
3/32 flat 25 ft. ..... .10
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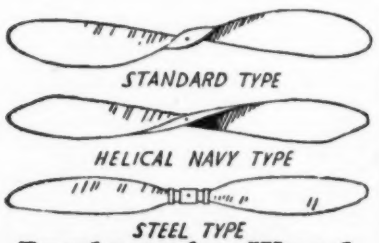

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10 "	40c	45c	45c
11 "	45c	50c	50c
12 "	50c	55c	60c
13 "	60c	65c	70c
14 "	65c	75c	80c
15 "	75c	80c	90c
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18 "	1.10		1.25
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stabilizer should be covered next with the same color combination as the wing. After covering the stabilizer, it should be slipped in the slot directly on top of longeron A and one-fourth or an inch behind bulkhead No. 7. Be sure the camber is on the bottom and glue in place. The reverse camber works as follows:

When the model is gliding fast or heading into a fair wind, the camber on the stabilizer tends to pull the tail down causing the model to move up and climb. As the speed decreases before it goes into a stall, the tail loses this pull and snaps back into normal flying position; thereby averting a stall and gaining the advantage of a strong head wind. The fuselage may be covered with red paper for visibility. The rudder is covered on both sides and glued in place, being sure it is lined up square. The nose block to fit on bulkhead No. 1 is now made from hard balsa and a one-quarter inch hole is drilled in the top for adding balancing weight.

The model should weigh just one ounce complete with balancing weight.

The towing hooks are next added in the places shown on the drawing and the glider is ready to go.

Flying

Always tow a glider into the wind and never run faster than is necessary to raise the model. On windy days it is possible to stand still and have the glider climb of its own accord. A piece of heavy music wire bent to a one-quarter inch circle is tied on the end of the towline. As long as the towline is being pulled or kept taut, the hook stays on. To release it, give the line some slack and it immediately drops off.

If your glider dives off on one side as it is being towed, give it enough wash-in to keep the wing up and then you are ready for a real flight.

The Aerodynamic Design of the Model Plane

(Continued from page 23)

motor. This is not so, for as can be seen from the graphs, the increase in torque with the increase in the number of strands is greater than directly proportional. Actually the maximum torque on any motor composed of strands of equal size is proportional to the square root of the number of strands cubed. Expressed mathematically, it is proportional to $\sqrt{N^3}$, where (N) represents the number of strands in the motor. This relationship is surprisingly accurate and will enable builders to determine the maximum torque increase on motors they may have occasion to use. Later, exact formulas will be given for various sizes and qualities of rubber.

Our next consideration is the variation of the number of turns it is possible to put into motors of various numbers of strands of the same size. The graphs indicate what many model builders know already. That is, the greater the number of strands, the fewer the number of turns a motor will take. The question is, *how great* is this variation?

It is obvious that doubling the number of strands in a motor does not halve the number of turns. Actually the number of turns possible is inversely proportional to the square root of the number of strands, or in mathematical form, (T) the turns, is proportional to $\sqrt{\frac{1}{N}}$, where (N) is the number of strands in the motor. This means that if a two-strand motor will give 1000 turns, a four-strand motor will take about 70% of 1000 turns, or 700 turns.

The performance of any model is proportional to the amount of work that the motor delivers so it is important to know how the work varies with any increase or decrease in the number of strands. The variation in work for the various motors indicated on the graph may be determined by counting the squares under the torque curves and comparing their number. Careful checking will show that the work delivered by the motor is nearly proportional to the number of strands. Actually the work is proportional to the number of strands (N), minus a constant (K) which represents some definite numerical value. The number of squares below the torque curves in graph No. 22, for instance, are equal to approximately (4.3) (N—0.77), where (N) equals the number of strands in the motor. Definite formulas for work delivered by various motors will be given later.

As most builders lubricate and stretch their motors when flying models in contests, it is probable that these graphs and the data given will be of great value to them. It is hoped so, at any rate. Careful study of the graphs will yield a great deal of useful information.

Next month data will be given on *stretched, lubricated, black rubber.*

The Albatros Fighters on Parade

(Continued from page 9)

ture in the D-10 was the new method of wing bracing; this machine being the second approved type in the "new light plane series," advanced improvements eliminating paired interplane struts left only one of these on each side supporting the upper and lower wings. These are commonly known as "I" struts, and those of the D-10 were practically the same in form as the struts used in the Laird racing biplane, trophy winner in the National Air Races of 1932. They were made up of light hollowed-out wood, presumably basswood, with the same approximate thickness as the interplane struts of the Dr-1 and D-7, being about 1¾" in center.

The "N" struts connecting the mid-wing section to the body were arranged practically the same as in the Dr-1 and incidentally, similar to the struts of the American Laird of Leeds 1932 trophy fame. The foreparts of the "N" were connected at their lower extremities well ahead on the nose to the upper body longitudinals approximately one third the distance from the front parts of the engine banks. Where in the Dr-1 the hind and lower parts of the mid-section struts joined in connection to the body, in the D-10 at this point, the "N" form was disjointed by a gap of approximately 8", changing the effect more to the forms of an inverted "V" and "I".

The new method employed in the rigging of the D-10 reduced the number of wires to four circular stranded guy-cables arranged diagonally in pairs on both sides. These were attached to bolted eyelets near

the upper connections of the "I" struts and joined to turn buckles where the lower wings connected to the body.

The landing gear and armament was the same in every respect as the D-9. The tail group was also the same, except as will be noted, the balancing portions at each end of the one-piece elevator were left off since the production of the D-9 as regards their position with the propeller. All other minor details were the same with the exception however of the mounting step which had been changed from the unique self-closing type to a simple stirrup affair attached below the cockpit to the lower body longitudinal.

Possessed with the most practical combined characteristics of the D-7 and D-9 models, the Albatros D-10 was capable of a speed of 208 kilometers per hour (app. 128 m.p.h.) at 1400 r.p.m., with a pay load of 537 lbs.

The year 1918 saw the engineers of the Albatros-Werke striving yet harder to produce faster and lighter single-seaters of the biplane class. It is very likely that the light construction of the "new series" D-9 and D-10 models was very acceptable over preceding structural designs, yet these machines did not excel the 1917 D-5a, Dr-1 or D-7 types in speed, which seems to have been of most vital importance at this time. Success in the experiments intensively conducted since the appearance of the D-7, appears to have been more evident with the advent of the Albatros D-11.

The D-11 carrying the serial or firm name L-41 was produced in February 1918. This unique and most impressive little fighting machine was the lightest and most radical in construction of the entire line of accepted Albatros Fighters. It was the first and only Albatros on record to employ a rotary engine which in this instance was not the usual 80 or 110 horsepowered affair, but a 160 h.p. Siemens and Halske S.H-3 engine. The Albatros D-11 being the last of the "new light-plane series" was identified in productive terms as "the altogether new form" of Albatros "D" type, and it was certainly the most successful of that distinguished line.

Considering the fact that the engine employed in the D-11 was of entirely different design opposing the stationary types of its predecessors, the actual official speed of this machine with its rotary engine is noteworthy for a model of this design. The D-11 did not surpass its predecessor in speed, yet, it was by far more practical in fighting characteristics, due mostly to structural strength and lightness in its compact makeup throughout.

The fuselage of the D-11 followed the same method of construction patterned by the D-10. The dimensions were practically the same with the exception of the length which was shortened by the use of the rotary engine.

At this section, a so-called canopy or hood served to cover the engine almost completely although provisions were made to allow a sufficient amount of air to pass through a circular displacement formed between the curved edge at the front of the hood and the circumference of the spinner. Similar to the engine cover of the Fokker triplane, a larger opening at the bottom provided a greater amount of air to pass over the exposed cylinders as they turned. However, the D-11 canopy was a two-piece detachable type and was much deeper than the cover used in the Fokker.

As will be noted in the photograph of this machine, an inspection plate was provided between the exhaust tube protruding out of the sides of the body ahead of the cockpit and partly covered by the rear end of the canopy. As a whole, the canopy was screwed down by its flaps to the lower body longitudinals on both sides while the top was held fast by the front attachments of the inverted "V" mid-wing struts to the upper body longitudinals.

The wing structure of this machine was similar to the forms of the D-10. As insufficient official dimensions are available to the author, it is doubtless, however, safe to say that the Albatros D-11 was the smallest of all accepted productions manufactured under that name. The wing spread of the D-11 was exactly 8 meters (app. 26'), approximately 3¼ feet shorter than the span of the D-5a and only 2½ feet greater than the Fokker Dr-1.

Twenty-four cambered speed type ribs were mounted on two main spars to form the upper wing, the main spar in this instance being slightly under 4" back of the leading edge proper. Ailerons employed only in the upper wing were of the same design as the flippers of the Dr-1 but as in the case of the D-10, they were streamlined and less exposed in the direction of flight than in earlier types.

As this machine was powered by an air-

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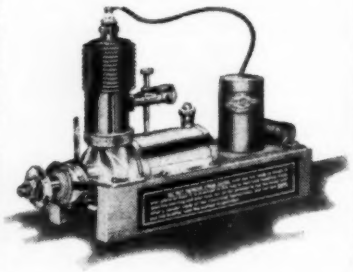

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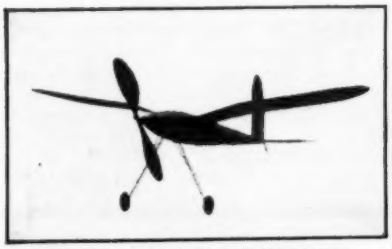

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cooled engine, it should be taken for granted that the "surface-cooler" or wing radiator was left out of its usual position.

The unique forms of the stubby lower wing halves were made up of eight short and slightly cambered speed type ribs to each half attached to only one main spar, placed approximately three-fifths of the chord distance from the leading edge, which in this case served to substantiate the absence of the second main spar. The span of the lower wing halves connected to the body comprised a total of about 23 feet.

The upper wing as will be noted, was cut out angularly at the trailing edge of the mid-wing section to approximately half of the chord distance, permitting a clear view for the pilot ahead and above. This same provision was repeated in the lower wings in curvature at those sections where they connected with the body.

There was no dihedral angle in either upper or lower wings. The interplane struts and bracing arrangements presented in the D-11 are considerably noteworthy in contrast to preceding methods employed.

The mid-section struts connecting the upper plane to the body were very much the same as the supports of the D-1. These consisted of a pair of inverted "V" struts connected at their open ends from the upper fuselage longitudinals to the upper wing spars at their points in pyramid fashion. The "I" struts connecting the upper and lower wings were of the same forms as those of the D-10.

Although the D-11 struts were reduced in thickness to approximately 1½" in center, they remained very substantial and uninclined to warp. It should especially be noted that the "I" struts of this machine were connected to the upper wing spars by a bolt at each end of the strut length, leaving a displacement of approximately 1½" below the cambered form, allowing a sufficient flow of air to pass through those sections on each side of the upper plane.

The same provision was made at the lower ends of these struts. As the lower wing was substantiated with only one main spar, the front ends of the "I" struts at the bottom were connected to the leading edges of the lower wing halves; in this case acting as a second spar.

The most notable feature in the bracing of the wing structures of the D-11 was the novel arrangement of an additional pair of streamlined interplane struts that took the place of previously used guy-cables in bracing the wing structure to the body. These were arranged in pairs on each side approximately 18" apart and connected at each end of the "I" strut length at the bottom; the first of these unique struts being connected on each side to the leading edges of the lower planes. At the top they connected to the inverted "V" mid-section struts at those points where they joined to the upper body longitudinals.

These additional struts were set diagonally, bracing the entire structure of the wings and were of the same approximate thickness of the upright members.

In viewing this machine directly from the front, the "I" struts would be seen to lean outward at an angle at the upper connections and inward at the lower wing attachments where they met the body braces which carried the strain from this point in pyramid form to the upper body longitudinals. The pyramid effect was brought down from the upper wing spars to the body by the inverted "V" struts of the mid-wing section.

Only one wire cable was used in bracing the wings. This was connected to the interplane strut attachments at the leading edges of the lower planes and also to the rear tip of the engine cowling on the lower body longitudinals bracing the lower planes. The tail group of this machine was the same as the D-10 with the exception of the horizontal fin and elevator which constituted as a whole less convex profile than those of previous forms.

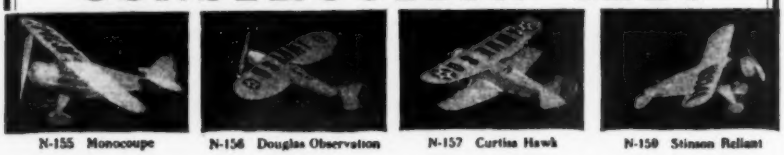
The landing gear of this machine, like those of preceding models was of the wire brace type with two diagonal cables bracing the front struts only. All four struts connected to the lower body longitudinals directly.

The wheels in this instance measured 710 x 85 m.m. in circumference while the track was 1760 m.m. The armament consisted of the usual pair of Spandau stationary guns mounted closely on the cowling. One of the guns was placed almost directly in the center of the cowl between the inverted "V" mid-section strut connections and the second gun was separated from the center one by the two right-hand strut connections.

The Albatros D-11 weighed only 494 kilograms (app. 1049 lbs.). It carried 90 liters of fuel and 30 liters of oil, sufficient for 1½ hours flying. The speed of this machine was 190 kilometers per hour (app. 119 m.p.h.) and the climb, 5000 meters (app. 16334 ft.) in 18 minutes.

The next article of this series presents the final designs of the Albatros Fighters and how the Albatros back-tracked to the forms of the greatest fighters of 1917.

CONSTRUCTION SETS



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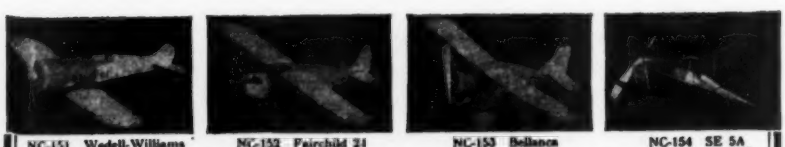

NC-151 Wedell-Williams 17½" wing spread NC-152 Fairchild 24 20" wing spread NC-153 Bellanca 20" wing spread NC-154 SE 5A 15" wing spread

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Building the Dewoitine D-33

(Continued from page 19)

piece of balsa ⅛"x3/16"x1" is glued to the inner side of rib No. 3 on each side close up to the leading edge. The landing gear struts are to be glued to this.

Rudder and Elevators

Like the wing tips, the outline of the rudder or fin is made of bamboo. It is shaped in the manner described in the case of the wing tip. When this is done, the bamboo is pinned down to the plan and the crosspieces of 1/16" square are glued in their proper place, as indicated by the drawing. The elevator is made next. First cut out the round tips from 1/16" sheet balsa. The edges, spars and ribs are of 1/16" square balsa. Fit these in place as indicated by the drawing and cement them together.

Covering

The top of the fuselage is covered first, one section at the time, (D to E, E to F, etc.) After this is done you may cover the sides. When covering sections such as the sides and bottom of the model, panels 5 or 6 inches long may be covered at one time. The paper is laid over the panel after the surfaces of the wood to which it is to be attached have been covered with banana oil. Do not put on too much cement as it will smear all over the paper. If this is done your job will not look neat. Trim the edges of the paper with a razor blade. When papering the wing, cover half of it at a time by starting at the center rib and painting one section with banana oil. Lay the paper on and smooth out with the finger tips. Pull the paper from the center rib toward the wing tip. Do not stretch across the wing.

After waiting a minute for the banana oil to harden slightly, fold the paper back, smear the banana oil over the parts of the next section and repeat this procedure until the wing tip is reached. The panels at the wing tips are covered with a separate piece. Trim the edges of the paper off with a broken razor blade.

The wing is covered in four sections: left top, left bottom, right top, and right bottom.

When everything has been completed, spray the body and wing lightly with water. This will tighten the paper when it dries. A coating of banana oil should then be applied. The proper solution for this is 50 percent banana oil and 50 percent acetone. The rudder and elevators are not doped.

Assembly

Now we start to assemble the model. However, before we can put the wing in place, a sheet of balsa 1/32" thick is cemented between panels H and D to the outer side of each side of the fuselage. These two sheets are the wing beds. Each one of these is composed of an upper and lower half. The lower half should be cemented in place first (each side). Then place the wing in position and cement it to the lower half of the wing beds. Then take the two upper halves and cement them to the sides of the fuselage so that they fit down tightly on top of the wing. It should also be cemented to the top of the wing. In order to do this, of course, the contour of the lower half of the wing airfoil must be cut into the lower half of the beds and the contour of the upper half of the wing airfoil must be cut into the upper half of the beds. This can be seen on the drawing.

Next make the rear fuselage plug and put it in place. The rudder is glued to the top stringer in a vertical position. It is best to give the model a little right rudder, about 1/32" deviation from the center line. Next the elevators are cemented to the top longerons as shown in the drawing. A bamboo brace extending from the lower longerons to the first panel section of the elevator spar helps to brace each half of the elevator. Next you may make the center section of the pants, which is cut from ¼" soft balsa. When this is complete the sides of the pants may be glued in place. These sides are 1/32" thick. When the glue is dry, round the sharp edges of the pants with sandpaper.

Now the landing gear struts of 1/16" x¼"x2½" hard balsa are cemented in place to the pants and to the block of balsa on rib No. 3. These are braced with 1/20" square pieces of bamboo, as indicated.

The wheels are 1 inch in diameter and can be cut with a coping saw and sanded. They are 3/16" thick. After they have been coated with banana oil, place them in the pants. The pants are then cemented to the landing gear so that a piece of (.028) wire cemented to the landing gear strut

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passes through the pants and the wheel, holding the wheel in place. Use several thin coats of cement on all joints of the landing gear.

Propeller

The propeller is cut from a block of medium balsa. A coping saw may be used to create the proper outline. Dimensions are shown on the drawing.

Next the propeller is cut out with a penknife to the shape indicated by the heavy lines in the lower drawing. When the two concave faces of the blades are cut, cut away the wood on the back faces of the blades. When each blade is of the same thickness, being about 1/8" at the hub and 1/16" at the tip, round the tips of the blades and cut away the hub, as shown by the dotted lines in the lower drawing. When this is done, the propeller is sanded and a smooth finish of two coats of banana oil is applied.

The propeller shaft is formed of .028 steel wire. One end of the shaft is formed into a loop or circular hook. The other end is forced through the nose plug through two washers and the propeller shaft hole at the exact center of the propeller. When the shaft protrudes from the outer side of the propeller, bend the end into a "U" and pull it back into the propeller hub. A little cement over the end of the shaft where it comes into the hub will help to hold it rigid. (The nose block used for this model can be bought in any large model supply house.)

Balancing and Flying

The model is powered with four strands of 1/8" flat brown rubber. A motor of these specifications is strung between the tail block hook and the propeller shaft hook. The rubber should hang with a small amount of slack, not stretched tight. To balance the model, support the model by the fingers at each wing tip where the 1/16" square spars meet. The model should be level when held in this way. If it does not balance properly, place small weights at the nose or tail as required.

This model weighs less than 1 ounce. When the rubber is lubricated and wound with a winder, 1 to 2 minutes duration may be expected.

List of Materials

1/16"x1/16" x 24" ..... 12 pieces
1/32" sheet ..... 1 piece
1/16" sheet ..... 1 piece
1/8" sheet ..... 1 piece
1/4" sheet ..... 1 piece
3/4"x3/4"x7" propeller
1 nose plug
2 strips of 1/4" bamboo
.028 music wire
4 feet of rubber motor
2 sheets of superfine tissue
celluloid for windows
1/2 ounce of colorless cement
1 ounce of banana oil
6 washers

Fundamentals of Model Airplane Building

(Continued from page 11)

ends of the bulkheads where they extend down 1/2" as shown. These top ones are located on the opposite sides of the bulkheads from the bottom ones. The front one is located on the rear side of bulkhead "B", while the other is cemented to the front side of bulkhead "C." These should be cemented to the bulkheads before they are put in place in the fuselage. The bottom ones consist of balsa pieces each measuring 1/16" wide and running from wall to wall of the fuselage. The front one is located on the front side of bulkhead "B" while the back one is located on the back side of "C".

The lower edges of each of these pieces must be flush with the bottom edges of the bulkheads. The bulkhead "D" cannot be cemented in place until the end hook has been bent and attached to its block. Note the plan of this under "End Hook." It is shown full-size in the plans and is bent from .037 piano wire. This is practically the same as No. 16 wire. Bend this piece to shape and then prepare the block on which it is mounted. Note this in the plan of the side view. It is 1/8" thick and 1/2" long, just the width of bulkhead "D." Cut this to size and cement the end hook around it in its exact center, as shown in the plans under "Bottom View." To locate this piece on the bulkhead is not difficult, but requires close attention.

Place the bulkhead in position in the fuselage and slip a scrap of 1/32" balsa into the elevator slots. Bring it forward to their front ends. Reach into the fuselage and make a pin prick on the bulkhead at the point where the underside of the elevator contacts the bulkhead. Remove the bulkhead and draw a horizontal line in pencil across the width of the bulkhead through this pin point. The bulkhead is braced with a piece of 1/16" sheet balsa which is cut to shape and cemented to its upper front side, as shown in the side view. This piece must be just long enough to extend from the top of the bulkhead down to the top of the hole in the bulkhead and must have its width and top curve. Cement this in place.

Note that the front edge of the elevator is 1/16" lower than its trailing edge. As the end hook block must be cemented against the underside of the elevator, it must be attached to the bulkhead at a very slight slant so that its top surface will be parallel to the undersurface of the elevator. The block is now cemented in place on the

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back of the bulkhead at this necessary slant with the end hook protruding through the hole in the bulkhead. When the cement has dried, coat the edge of the bulkhead and both ends of the end hook block and slip it in place. Use model pins to hold it in place until dry. The scrap strip in the slots can then be removed.

Elevator and Rudder

The elevator is shown on graph in the plan. This should be made before the fuselage is completed. Cut it out from a solid piece of 1/32" sheet balsa, after tracing its form on the wood. It is reinforced with two pieces of 1/32" sheet balsa on both sides, as shown in the graph plan. When the elevator has been sanded smooth, it should be slipped into its slots for final test. The underside at the front, where it contacts the top of the end hook block, is coated with cement, as are the edges of the slots and the elevator is slipped into place. At the same time, clamp the lower rear ends of the fuselage tight together and run cement in the cracks between the fuselage and the undersurface of the stabilizer. Do not cement the rear ends of the fuselage together yet. When the cement is dry, the rudder may be cut out, finished and put in place in the end of the fuselage with cement to hold it on all touching parts. When doing this, apply cement to the ends of the fuselage walls and bring them together. Hold with model pins until dry. Allow plenty of drying time for this assembly, as well as for that of bulkhead "D," as these parts carry considerable stress.

Complete the tail unit by cementing a 1/32" sheet balsa strip across the under side of the fuselage between bulkhead "D" and its trailing end. This must be sanded down along its edges to match the edges of the fuselage, as shown. Cement the tail skid, cut from a 3/16" thick, 3/8" wide and 1" long balsa block to the forward-center portion of this last balsa strip under the fuselage, as shown in the plans under "Side View."

Reinforcing Fuselage Bottom

Cut a block of 1/4" thick balsa wood just wide enough to fit between the stringers on the edges of the fuselage in front of bulkhead "B." This must be 1 3/4" long and is shown in the plans as "E." Cement it between the stringers just in front of the bulkhead "B." Apply cement to its edges and rear end, where it contacts the bulkhead. A second underbrace of this type is added between the stringers just behind bulkhead "C" and is shown as "F." This is cemented to the stringers and the bulkhead "C." A longer reinforcement is added directly under these. This consists of a 1/32" strip of balsa and extends from a point 1 3/4" in front of bulkhead "B" to a point 1 1/2" behind bulkhead "C." It is cemented to braces "E" and "F", the stringers, fuselage edges and the bottom edges of bulkheads "B" and "C."

When these pieces have had plenty of time to dry, the wing slots are cut out on both sides of the fuselage. Note that these extend from bulkhead "B" to bulkhead "C."

Complete the fuselage by cutting out the nose block. This is shown on the graph portion of the plan, as well as in the side view. It is carved from a 1/2" block of balsa wood to fit exactly the nose of the fuselage. Place this in position against the bulkhead "A" to test for size. Locate the 1/4" hole from that of bulkhead "A" and bore. Test to see that the hole in "A" and this hole are in line with each other, when the block is in place. Cement it to bulkhead "A" and the front edge of the fuselage cowling.

Propeller

The propeller is carved in the usual manner from a 3/8" x 1 3/4" x 10" long block. The shaft, shown full size in the plans, is bent from .037 piano wire, or No. 16. The bearing is cut from a one inch circle of tin. Draw a second inner circle on the tin with a diameter of 5/8" and then cut out prongs between the edge and this second circle. These prongs are then bent up towards the center. Note that the prongs should bend toward the hook and the shaft, as shown in the illustration, Fig. 1.

Before putting the shaft in place, there should be a center hole punched in the bearing fitting. After the shaft is in place through the bearing, put on the washer. Then push the straight end of the shaft through the hole in the propeller hub. Bend over the end of the shaft at the front of the propeller, as indicated in the drawing of the shaft. Then pull it back into the propeller and cement it in place.

Now make the propeller cone as was explained in the January issue of *Universal Model Airplane News*. (See page 8, figure 3.) Cement this in place on the hub which should be cut down to 5/8", as shown on the plans.

Now the propeller assembly is ready to be attached to the fuselage nose. Thrust the hook of the shaft through the hole cut in the nose block and bulkhead "A" and force the prongs into the surrounding wood of the nose piece. When it is forced one-half way into the wood, coat the prongs and the balsa wood around the hole in the nose block, with cement. Then force the bearing into the balsa tightly, wiping off the surplus cement. Be sure to oil the bearing.

Wing

The wing is constructed of two lengths of 3/64" sheet balsa. Obtain two pieces and cut them to 4" wide and 13" long. Round one end of each to form the wing tip, as shown in the plans under "Wing." The eight ribs that are needed are cut from 1/16" hard balsa, as shown. These are given full-size in the plan. Cement the ribs in place, carefully drawing the wing over them and hold each until dry with model pins. When the wing is curved by the ribs, its chord will be 3 1/4". The two halves are cemented together with a 2" dihedral at each wing tip. Balsa strips are used on the underside of the wing for strength. These should be cut from 1/32" sheet balsa, 1/4" wide and 1" long, as shown by the dotted lines on the wing. They are cemented along the leading and trailing edges. Four will be needed. Locate them next to the two inner ribs, as shown. Go over the entire wing with sandpaper until perfectly smooth.

Landing Gear

Two views of the landing gear are shown in the plans. It requires two lengths of

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1 3/4" long A 30c

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3/4" long 5c
1" long 5c
1 1/2" long 9c

TYPE F
1 1/4" long 10c

TYPE E
1 3/4" long 15c

DUMMY RATCHET GUN
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Something New
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Balloon Tire Alum. Disc
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1 1/2" dia. ..... 30c pr.
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PROPELLERS

Hawk Type 2-bladed	Hawk Type 3-bladed	Standard 2-bladed	Standard 3-bladed
2 1/2" 25c	1" 35c	1 1/2" 10c	1 1/2" 15c
3" 30c	1 1/2" 45c	2 1/2" 15c	2 1/2" 20c
3 1/2" 35c	2" 50c	3" 20c	4" 30c
4" 35c	2 1/2" 60c	3 1/2" 25c	4 1/2" 40c
5 1/2" 40c	3" 70c	4" 25c	5" 50c
6 1/2" 40c	3 1/2" 80c	5" 30c	6" 60c
7" 55c	4" 90c	5 1/2" 35c	7" 70c
8" 65c	5" $1.00	6" 40c	8" 80c
9" 73c	6" 1.10	6 1/2" 45c	9" 90c
10" 85c	11" 1.25	6 3/4" 50c	10" $1.00

Props can be had up to 24 in. dia. Postage 6c each.

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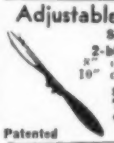

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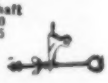

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Dia.	Drag Ring	Open Face	Closed Face
1"	15	15	15
1 1/2"	15	15	15
2"	18	18	18
2 1/2"	20	20	20
3"	25	25	25
	30	30	30

Postage 6c

WORKING BRASS TURNED

Take-up	Long	Plain End	Toggled End
1/2"	5/8"	.25c	.30c
3/4"	7/8"	.30c	.35c
1"	1"	.30c	.35c
1 1/2"	1 3/4"	.50c	.55c

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1/2" ..... 10c each
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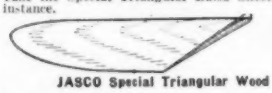

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.037" or No. 16 piano wire. The longer of the two pieces is bent so as to fit around the underside of the fuselage snugly, as shown in the illustration, Fig. 2. A shorter length is bent to fit around the underside of the fuselage and then its ends extend down to the long piece, where they are cemented and bound to them, as shown, with thread. *Hard wood* wheels of 1¾" diameter are used on the axles.

Slip the two fuselage attachments around the underside of the fuselage in the location shown on the plan of the side view, bend "S" hooks for each side of the same wire and hold with rubber bands around the top of the fuselage. Note this assembly in Fig. 2.

Motor

If you wish normal flight, eight strands of ⅛" x 1/30" brown rubber will serve, although Mr. Grant recommends using ten strands if unusual power, an R.O.G. takeoff or altitude is desired. Obtain a single strand of this rubber, loop it eight or ten times after tying together its ends and string it between the propeller shaft and the end hook. You will need a piece about 172" for the ten strands and about 140" for the eight strands.

As brown rubber is being used, a good lubricant should be employed. The motor may be hand or winder wound, as you wish. In the plan under "Side View" will be seen a point indicating the center of gravity. Attach the wing with a single rubber band in the usual manner. Adjust it until the center of the wing is slightly behind this point. The model is then completed.

Weight the nose or the tail of the model as required if it does not balance properly within the limits of the wing adjustment in the wing slot.

The motor may be wound 400 times when first wound and 450 times after four windings, if lubricant is used, without stretching the rubber to wind it. If no lubricant is used it may be wound 275 times.

Air Ways—Here and There

(Continued from page 17)

This is shown in picture No. 12. This trophy is competed for each month. The winner is awarded a medal which he retains, the trophy being held at the headquarters of the club to which this winner belongs. Each state, such as Tasmania and New Zealand, compete for the trophy for one year.

Picture No. 13 is an exhibition of models at a contest which was held recently by the Model Flying Club. At the extreme left is a Wakefield job. Mr. Freshman tells us that the Australian boys are very active and are becoming more expert every day. We hope that it will be possible for them to compete in some future national contest held in this country.

CLUB NEWS

Los Angeles Model Club

Picture No. 14 shows a group of the winners of a contest recently held at the Los Angeles, Calif., Airport. Many of these winners are older men who competed in the Open Class. Model builders now do not have to cease their contest activities when they reach the age of 21. A special class has been provided by the National Aeronautic Association for these enthusiasts.

Glen Ellyn Model Airplane Club

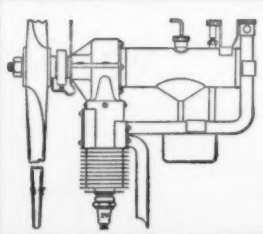
The Glen Ellyn Model Airplane Club of Glen Ellyn, Ill., has been exceedingly active in the past with rubber-powered models. Now, it is building a gas job, which is shown in picture No. 15. The model has a span of 8 feet with a 12-inch chord. The airfoil is an N.A.C.A. M-6. It has been designed to be exceedingly stable. The fuselage has a good size moment arm, being 6 feet long. Upon tests, this model has shown a glide of ten to one, with a stalling speed of 14 miles per hour.

It seems that the members of the Glen Ellyn Club have had the same experiences that many other builders have had who have taken up the gas model hobby. It has taken them considerable time to adjust their model for flight and they have gained considerable experience so that the flights will be consistent. Following is what Bill Shaw, secretary of the Club, has to say about some of their experiences:

"The first time we tried to fly our model the motor stopped while the plane was in a 45-degree climb, 25 feet off the ground. Immediately the nose of the plane dropped and it power-dived into the ground. The only damage was a broken motor mount.

"On the next flight, we gave the elevators more lift and moved the batteries slightly forward so the plane wouldn't zoom up into a stall like it did the first time. After building two motor mounts of which one was metal and didn't work, we got the model into the air and at about 30 feet the nut came off the prop shaft and the motor stopped. The fuselage of the model was shoved into a car and it was taken to a garage and we got a new nut and washer. In about one-half hour we had the model in the air for its first real flight which lasted for almost 4 minutes. The model obtained a height of about 1,000 feet before the motor stopped. On its way down, the model hit a tree and that broke the prop and pushed the front end of the plane in a little bit, but during the week the model was fixed and ready to go the next Sunday.

"We took the model to a near-by airport where a few of the members of the Club have a Northrop glider. The day (Oct. 21) happened to be terrible because it was so windy. However, we let the model go because we were all so anxious to see it fly. It got off to a good start, but when it had about 30 feet altitude, it turned down wind and went across the field at about a 2-foot altitude and at a terrific speed. At that time there were some tense moments, but it all turned out for the best



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Stroke.....1 5/16 Prop.....18" diam. H.P.....½-¾

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when the model turned into the wind and rose like an elevator. The model circled and drifted with the wind. It went over the clouds which were at about 3,000 feet, but in a few minutes we regained sight of it because the motor had stopped and the plane glided through the clouds and later came to a perfect landing about 10 miles from the airport. It was up for 22 minutes, 30 seconds, on 1¾ ounces of gas. The model landed in a valley so there was no danger of a wind. The model was chased in three cars and in an Aeronca, but the pilot of the plane lost sight of the model when he happened to look away to adjust the throttle. When the model flew against the wind, it flew backwards so you can get an idea of how fast the wind was blowing."

Zanesville Model Club

Recently the Zanesville Model Airplane Club opened its fall activities by holding a meeting and a flying scale model contest at the Y.M.C.A. at Zanesville, Ohio. Several prominent model builders were present from Columbus, Ohio. They were Bob File, Emerson Limes, and Roger Magee. They gave short talks and some interesting flying demonstrations. Later they acted as judges for the scale model contest, first place in which was taken by Henry Sturtevant with a flying scale Stinson, built from plans in the October 1934 issue of UNIVERSAL MODEL AIRPLANE NEWS. The models were judged for neatness, accuracy of construction and duration. The primary purpose of the meeting was to determine ways in which new club members might be enrolled. The club is directed by Mr. Fred Burns, Robert McKee acts as advisor. We suggest that any man in the neighborhood of Zanesville get in touch with Mr. Burns or Mr. McKee at 702 Ridge Avenue, Zanesville, Ohio, if he wishes to join this progressive organization.

Suburban Aero Club

An unusual aviation club has been formed at Darby, Pa., in the suburbs of Philadelphia, by three students of the Rising Sun Aircraft School. The purpose of this club is to afford its members an aeronautical education by research classes, airplane rebuilding, motor overhauling, wireless, theory of aeronautics, and the building of a 6- to 8-foot model plane with a miniature gasoline engine. Mr. Thomas J. Pohlig of 27 Chester Pike, Darby, Pa., is the president. He wants to know what our readers think of a club of this kind.

San Antonio Model Airplane Club

We are glad to see that a club has been formed at San Antonio, Texas. It is not surprising that this town should be air-minded, as it is the town in the United States which has been associated with aviation more than any other. The club was organized July 27 and at the present time has fifty-six members. Mr. P. H. Hebert is the founder and Mr. L. G. Ragsdale is secretary. Weekly meetings are held as well as two contests each month. A complete supply shop has been opened at club headquarters, from which supplies are available to any who wish to purchase them. Profits from the sale of supplies are used to defray costs of club operations. All communications to this club should be addressed to P.O. Box 246, San Antonio, Texas.

Miniature Airplane Contest

A contest for the State Championship was held recently at the Kansas Free State Fair, at Topeka. Strong winds and rain made the flights rather disappointing. However, some good indoor records were made. Russell Culp won the State Championship by taking three first places, one second and two third; netting twenty-six points. Norman Koenig was second, winning one first place and two second. He netted twenty-one points. George Allen and Ted Nelson tied for third place, each netting eleven points.

Galt Model Airplane Club

An open contest was recently held at Galt, Canada, by the Galt Model Airplane Club. Over forty model builders from various towns were present. Harry Burrows of Toronto, won the contest by taking two first places. The contest was under the direction of Mr. J. T. Dilly. After the contest a banquet was held to replace the energy of the boys who chased models during the day. Active model builders will appreciate this. Some of those prominent in model work who attended were, E. O. Houghton, Adam Sime, W. Alexander and T. Storey.

Model Aircraft Engineers

The Model Aircraft Engineers of Milwaukee, Wis., has recently held an election for new officers. The new officers are:

Board of Governors: Roy Yoss, Joseph Stieb, Ray Stieve, Harold Sinakey and Leo Fuchs.

President: William Fluegge.

Secretary-Treasurer: Herbert Markwiese.

Sergeant-at-arms: Roy Yoss.

Under the competent direction of these men the club is looking forward to an active season.

Minneapolis Model Aero Club

Minneapolis, the Mill City of the United States, is now whole-heartedly engaged in the game of model airplane building. During the last few years this hobby has been growing by leaps and bounds and now is going full blast here.

Through the efforts of one of the model builders, Vernon Hanson, the boys now have a large central club organized. Meetings are held once a month. Famous pilots and aeronautical engineers are the guest speakers at these meetings and many fine films of aviation interest have been shown. And to finish the meeting properly, "EATS" are served. Dues are only 5 cents a month and the money is used for "eats," membership cards, etc. The club has some 300 active model builders and nearly 2,000 others that are on the club lists. Contests are held every 2 months and are closely contested affairs.

A Flying Scale Contest was held in August with a Curtiss A-8 Attack flying 56 seconds to win. A weight rule was used in this contest. The winners were:

Vernon Hanson, first; Robert Bond, second; and Carl Berglund, third. Flying

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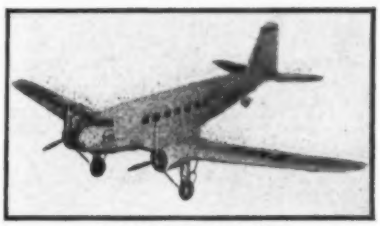

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This model masterpiece weighs 6 oz. with headlights, venturi tubes, windows, doors that open, the new split trailing edge flaps (air brakes) wing and tail lights. Think of a wing span of 42½"! A length of 31"! Then think of the value represented—at our low price for complete kit. Plus P. P. 50c..... **$5.00**

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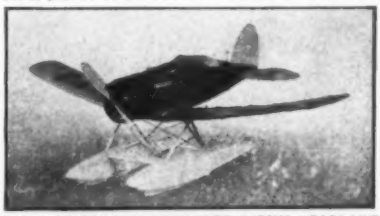

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BECOME a Model Expert with our airplane course. It contains four complete model kits, 9500 words of instructions, 70 illustrations, $1.10 postpaid. Model Aircraft, 2923 Lafayette, Houston, Texas.

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BROTHER Can you Spare a Dime—If you can, send it to me and I'll send you my 1931 Low Priced Aviation Material Catalogue. Karl Ort, 655 W. Poplar St., York, Pa.

time was poor because of rainy weather.

A Scale and Flying Scale Contest was held in September at the Northwestern National Bank. Prizes were furnished by the Bank and Roberg Brothers Stores, the sponsors of the club.

Officers of the club are: Vernon Hanson, President; Robert Bond, Vice-President; Leonard Wheeler, Secretary-Treasurer and Adrian McGinnis, Sergeant-at-Arms. The club gives notice that they are out to beat some of those world records made this year at the National Competition.

New Glider School at Elmira

Warren E. Eaton, President of the Central New York Airways, Inc., announces the opening of a school for gliding and soaring at the Caton Avenue Airport, Elmira, N. Y. This should be very interesting to advanced model builders who wish to take up gliding. We suggest that they write to Mr. Earl R. Southee, Business Manager, % Association of Commerce, Federation Building, Elmira, N.Y., for full information.

Glider Club Activities

Recently the sport of gliding has acquired considerable impetus in this country. The contest recently held at Elmira, N.Y., attracted great attention. Many former and present model builders were there. These young men, having acquired a reputation in model flying, have been looking for new fields to conquer and have taken up glider flying to fulfill these desires. One of the model builders whom you all know is Mr. Frank Zaic. The contest was conducted by Mr. Earl Southee, who has been active in aviation, to the knowledge of the editor, since 1914.

The Associated Glider Clubs of New Jersey held their first meet on Sept. 1, 2 and 3. The meet was held at the glider field located at Lyons, N.J. The "Y" Flying Club won first place for groups with a total of 1,121 points. The Aero Club Albatross took second honors, Newark Tech Glider Club, third; Ace Gliding and Soaring Society, fourth; Trip Gliding Club fifth. The events included spot landing contests, duration flights, and bomb dropping. Only primaries and secondaries were eligible to compete.

Vancouver Model Club

Jack Gould writes us from 2133 Cypress Street, Vancouver, B.C., Canada, telling us of a contest which was recently held there. The R.O.G. was won by Desmond LeFluffy with a flight of 17 minutes, 51 seconds. This flight caused considerable excitement as the plane was lost from sight after it covered quite a distance.

Onondaga Model Club

The Onondaga Model Club of Syracuse, N.Y., was asked to take over the Model Airplane Contest to be held at the New York State Fair this year. The Fair was held from Sept. 2 to Sept. 11. The Airplane Contest was held on Monday, Sept. 3. It was run under the N.A.A. rules for model airplanes and gliders.

The following events were run with two classes in each event; namely Junior and Senior; Glider, Single Pusher, Twin Pusher, Outdoor Commercial. The Exhibition Scale Event was an open event.

The high point winner of the Junior Events will meet the high point winner of the Senior Events for the New York State Championship.

Correspondents

The following readers will welcome letters from other UNIVERSAL MODEL AIRPLANE NEWS fans and promise to answer all they receive:

Lawrence Bernstein, 1225 Findlay Avenue, New York City.

Benton Holt, 1107 North First Street, Monroe, La.

Charles E. Sargeant, 90 Durham Road, Bromley, Kent, England.

Robert Calder, Derbyshire, "Burnie Brae," Beatrice Street, Taringa, Queensland, Australia.

R. Bruce Lester, R.R. No. 3, Forest, Ontario, Canada.

Fred Fisk, 9833-78th Avenue, Edmonton, Alberta, Canada.

Neil E. Secor of 2619 James Street, Syracuse, N.Y.

F. Leroy Hart of Fairland, Okla.

John G. Pritchard of 344 S. Second Street, Bangor, Pa.

Joseph Shields of 76 State Street, Auburn, N.Y.

Francis C. Powers of 5 Meadow Street, Salem, Mass.

Alan Clark of 1 St. Minuer Avenue, North Sydney, Sydney, Australia.

Aviation Advisory Board

(Continued from page 33)

added together to get the total wing surface area.

John Groat of 41 Pine Street, Thorold, Canada, wants information on the following question:

Question: Would not an all-wood constructed plane be too weak to mount a high horse-power motor?

Answer: High horse-power motors have been mounted in all wood planes, especially during the war. An example of a modern plane whose fuselage is all wood, except for possible metal fittings, is the Lockheed Vega and Altair; also, it is surprising to know that the DeHavilland Comet, which won the London-Melbourne Race is an all-wood plane. The fuselage is monocoque and the wings are wood covered.

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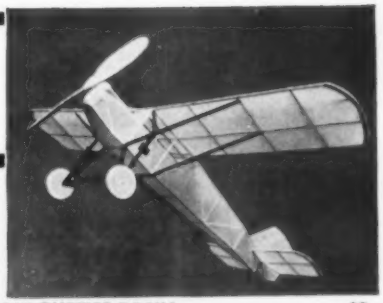

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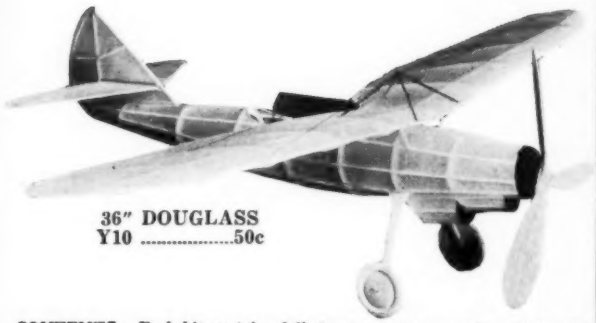

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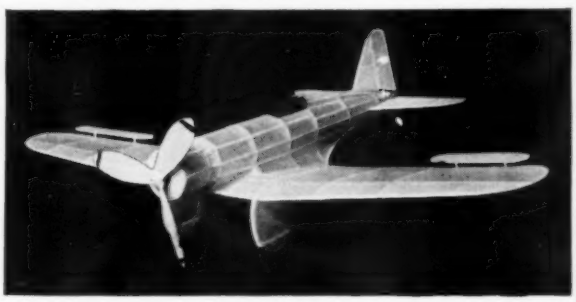

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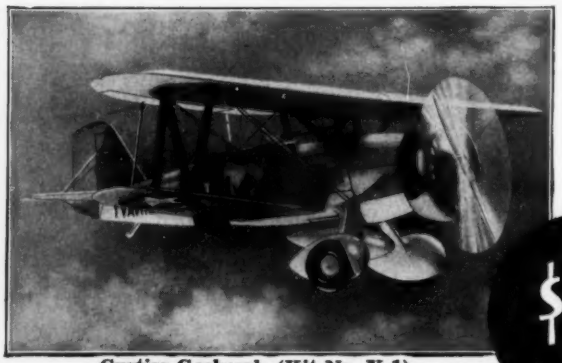

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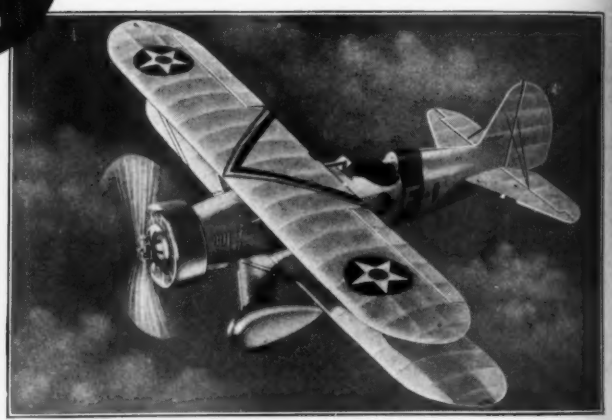

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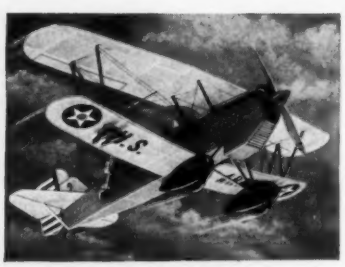

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